IX. *An account of trigonometrical operations in the years* 1821, 1822 *and* 1823, *for determining the difference of longitude between the Royal Observatories of Paris and Greenwich. By Captain* Henry Kater, *V.P.R.S.*

Read January 31, and February 7, 1828.

Section 1.

In the year 1790, a series of trigonometrical operations was carried on by General Roy, in co-operation with Messrs. De Cassini, Mechain, and Legendre, for the purpose of connecting the meridians of Paris and Greenwich. In England, the work commenced with a base measured on Hounslow Heath, whence triangles were carried through Hanger Hill Tower and Severndroog Castle on Shooter's Hill, to Fairlight Down, Folkstone Turnpike, and Dover Castle on the English coast; which last stations were connected with the church of Nôtre Dame at Calais, and with Blancnez and Montlambert upon the coast of France. An account of these operations will be found in the Philosophical Transactions for 1790.

In the year 1821, the Royal Academy of Sciences and the Board of Longitude at Paris communicated to the Royal Society of London their desire, that the operations for connecting the meridians of Paris and Greenwich should be repeated jointly by both countries, and that commissioners should be nominated by the Royal Academy of Sciences and by the Royal Society of London for that purpose. This proposal having been readily acceded to, Messrs. Arago and Matthieu were chosen on the part of the Royal Academy of Sciences, and Lieut.-Colonel (then Captain) Colby and myself were appointed by the Royal Society to co-operate with them.

The instrument employed on this occasion was Ramsden's great theodolite, the property of the Royal Society, the same which had been used by General Roy. A party of the Royal Artillery and a sufficient number of tents were supplied by his Grace the Duke of Wellington, then Master General of the

Ordnance, and every means were afforded which could tend to facilitate the work.

It was at first proposed to adopt some one of the distances given by the Trigonometrical Survey of Great Britain, as a base, and to connect this with General Roy's stations upon Fairlight Down and near Folkstone Turnpike. But the attempt to discover General Roy's stations upon Fairlight and at Folkstone proved, in the first instance, fruitless; and unfortunately, the gun which had marked the important station of the trigonometrical survey on Beachey Head, was not to be found. It is to be feared that, in consequence of some misapprehension, it had been removed along with some old guns which were formerly near that place, and thus one of the most valuable points of the survey of Great Britain was irrecoverably lost.

Colonel Colby was so good as to allow Mr. Gardner (then one of the assistants on the trigonometrical survey, and now agent for the sale of the Ordnance maps,) to accompany us; and to the talents, zeal, and exertion of that gentleman, on various occasions of difficulty, we were much indebted.

The signals used for connecting the stations upon the coasts of England and France were lamps with compound lenses, constructed under the direction of M. Fresnel, and of which he has published an account. It will be sufficient here to mention, that the lens, composed of numerous pieces, was three feet in diameter, and that the light far exceeded that of any of our light-houses, appearing at the distance of forty-eight miles like a star of the first magnitude. Staffs were also erected near the lamps, but these were only occasionally visible.

Having selected convenient stations upon Fairlight Down and near Folkstone Turnpike, and placed the lamps there with steady men to attend them, the party crossed the Channel on the 24th of September 1821, and proceeded to Cape Blancnez, a station to the south-west of Calais. Here we found an old guard-house, the roof of which was partially destroyed, but of which we nevertheless took possession, as it promised a less comfortless abode than our tents at that season would have afforded. At Blancnez we experienced very tempestuous weather; and on the night of the 4th of October it blew so violently that the men's tents were carried away, and we were obliged to take down the theodolite to preserve it from injury.

The observations at Blancnez having been concluded on the 7th of October,

we proceeded to Montlambert (or as it is commonly called Boulambert), a small fort situated on a height near Boulogne; and by the 9th of October the instrument was ready for observing. In the course of our work at this station some delay was experienced in consequence of the lamp at Fairlight not being lighted, and M. MATTHIEU and Mr. GARDNER were dispatched to know the cause of this omission. On their arrival at Calais, finding no packet ready to depart, their anxiety led them to cross in an open boat, at night, in weather so tempestuous that they were nearly lost. They found that the glass chimneys of the lamp at Fairlight were all broken; but their ingenuity remedied this by joining the remaining pieces together; and on the evening of the 13th the light was seen, and satisfactory angles obtained between it and the other stations.

On the 14th of October, the observations at Montlambert being completed, we left that station for Calais. On the 17th we re-crossed the Channel, and on the 19th proceeded to Fairlight. Here I endeavoured to find General ROY's station, and discovered the cause of the failure of the former attempt. In the account of General ROY's operations, his station is stated to be 347 feet southward from the Mill; and the angle at his station between the Mill and Fairlight Church is given. Now it happens that the mill which stood in General ROY's time has been destroyed, and another built upon the Down in a different situation. A circular trace however of the old mill was at length discovered; and the distance from its centre to the station having been carefully measured nearly in the proper direction, a small theodolite placed at the end of this radius was shifted until the centre of ROY's Mill and Fairlight Church subtended the given angle. On digging under the theodolite, the wooden pipe by which General ROY had marked his station was found at the depth of four feet. In order to preserve this point, a millstone having the words "ROY'S STATION" cut upon it, was placed level with the surface of the ground, its centre being precisely over the centre of the pipe.

The observations at Fairlight were completed by the 22nd of October, and the party proceeded on the 24th to a station chosen near Folkstone Turnpike.

In order to carry on the series towards London, stations had been selected on Stede Hill and Wrotham Hill; but as these were not visible from Folkstone, it became necessary to employ an intermediate point on Tolsford Hill.

A staff had been erected on General ROY's station upon Dover Castle, in

order to connect this with the Church of Nôtre Dame at Calais. But as it would have been peculiarly inconvenient, and would have been attended with some risk to have got the great theodolite upon the Castle, the angle there was not taken; but the distance between Dover station and Nôtre Dame has been determined by means of two sides and the included angle, in a manner which will probably appear to be sufficiently satisfactory, as no other station is dependent upon this distance.

The observations at Folkstone were completed on the 27th of October; and with great regret we now bade adieu to our much-esteemed companion M. Arago, who left us for Paris; and as the season was too far advanced to admit of any further proceedings, the party returned to London.

It was now our intention to connect our triangles with the base measured by General Roy upon Hounslow Heath; but though upon examination it was found that the guns marking the termination of this base still existed, it was not thought advisable to attempt to avail ourselves of it, from the many buildings which intervened, and which prevented one end of the base being seen from the other. We were therefore under the necessity of employing the distance from Severndroog Castle to Hanger Hill Tower, as these were the nearest stations to General Roy's base that could be identified with sufficient precision.

During the operations of 1821, I was strongly impressed with the inconvenience of changing the zero point of the theodolite, in order to obtain the angle upon different arcs, so as to do away errors of division; and on my return to London I caused four additional microscopes to be adapted to the instrument, by Mr. Carey. On this important alteration I shall have further to remark in the Appendix.

The summer of 1822 was employed in the choice of stations, one of which was the temporary meridian mark erected near Chingford for the Royal Observatory. This station was chosen, in order that a side of one of our triangles might coincide with the meridian of Greenwich, and that the azimuths of the different stations, with respect to that meridian, might thence be deduced with greater accuracy than might have resulted from observations of the pole star.

Stations were also selected upon Leith Hill, Wrotham Hill, Stede Hill, and Crowborough. We anxiously sought a station to the south of Chingford, for

the purpose of joining it with Severndroog Castle, in order to connect these points with the Royal Observatory; but our endeavours were without success, and we were obliged to content ourselves with accomplishing this object by intersecting the north-west pinnacle of Westminster Abbey, and also the Cross of St. Paul's. The different methods, however, by which the distance from Chingford to Severndroog has been obtained, and the small difference in the results, leave little reason to fear any error of importance.

On the 12th of August 1822, the party proceeded to Hanger Hill Tower. This station is very unfavourable for observations, in consequence of the unsteadiness of the building. Here we felt the great advantage of the additional microscopes with which the theodolite had been furnished, as by their aid we were enabled to accomplish that in a week which it would otherwise have required a much longer period to have completed satisfactorily.

On the 17th of October, our observations being concluded at Hanger Hill, the party left that station for Fairlight Down. Lamps were employed at the stations on Wrotham Hill and Tolsford, and the observations at Fairlight were completed by the 28th.

From Fairlight we proceeded to Folkstone Turnpike. Here, as most of the required angles had been obtained the preceding autumn, little remained to be done, and we were enabled to quit this station on the 5th of September.

Before the party left Folkstone, an attempt was made to discover General Roy's station; and at length the pipe which marked it was found in a state of complete decay, at the distance of three feet to the North-west. The angle between Roy's station and Fairlight being 80° 13′.

The party now proceeded to Tolsford Hill, a commanding eminence, from which the stations on the French coast are visible. Here we saw Fiennes, and succeeded in obtaining the angle between it and Montlambert.

From Tolsford we proceeded on the 9th of September to Stede Hill, a station in the grounds of William Baldwin, Esq. To this gentleman we were indebted for the most kind and friendly attentions, and it would be difficult to do justice to the warm hospitality which we experienced from him. Not only was every thing that could facilitate our objects instantly supplied; but the personal comfort of the whole party, including that of the private soldiers, provided for with the kindest solicitude.

Our observations at Stede Hill being completed on the 14th of September, we left that station on the 16th for Crowborough, and on the 25th proceeded to Leith Hill, a remarkably fine commanding station.

We left Leith Hill on the 5th of October for Wrotham Hill, where, having completed our observations, the party proceeded to Severndroog Castle upon Shooter's Hill. We had here to erect a shed upon the summit of the tower to cover the instrument: this was speedily accomplished by the kind assistance afforded by Lieut. Colonel JONES of the Royal Engineers, who supplied us with carpenters and all that was necessary from Woolwich.

On the 24th of October the theodolite was safely hoisted by proper tackle to the summit of the tower, and the flagstaff having been removed, the instrument was placed with its centre precisely over the spot which the flagstaff had occupied. A platform of boards was attached to the brickwork, so as to be clear of the leads upon which the instrument rested: so unsteady, however, was this building, that we thought it advisable ultimately to reject the angles which had been taken by reading off the five microscopes, in consequence of the disturbance which was found to be occasioned by any person moving upon the platform. We therefore resolved to content ourselves with reading the two opposite microscopes, which might be done without any change of position in the observers. The angles, however, which were deduced from the observations with the five microscopes are given in the Appendix, but are separated by a line from the results furnished by the two microscopes, from which they differ but little, and which have been employed in preference.

At this station we experienced considerable difficulty in obtaining the requisite angles with Hanger Hill, as the signal erected upon that tower was seen only once, in consequence of the intervening smoke of London. At length Colonel COLBY thought of a method by which this difficulty was overcome. Tin plates were nailed to the staff upon Hanger Hill Tower, the plates being disposed above each other in certain angles, so as to reflect the sun's rays to Severndroog. This contrivance, which answers the purpose in a certain degree of the heliostat of Professor GAUSS, was perfectly successful; each plate gave in succession a neat image of the sun resembling a fixed star, which was seen through a smoke so thick that even the hill was invisible.

From Severndroog the party proceeded to the station at Chingford, and by

the 10th of November the instrument was ready for observation. The season, however, was so far advanced that it was found impossible to obtain the requisite angles with the Royal Observatory or with Westminster Abbey. The health of the men too began to suffer from their being encamped upon a wet clayey soil; we therefore thought it prudent to strike our tents on the 18th, and return to London.

Colonel COLBY intending to use Chingford as one of the stations of the Trigonometrical Survey of Great Britain, the theodolite belonging to the Ordnance was placed at Chingford in July 1823, and with it the angles were obtained which we were not able to observe the preceding autumn. This instrument is in every respect similar to that belonging to the Royal Society, excepting that Colonel COLBY had recently caused three equidistant microscopes to be adapted to it, which may be used instead of the two microscopes formerly employed.

The transit-room not being visible from Severndroog Castle, the staff erected upon the Royal Observatory was placed upon the centre of the octagonal room of that building; and the angle at Chingford between the staff and the centre of the transit instrument, as well as their distance from each other, is calculated from data furnished by the Astronomer Royal.

As the preservation of the stations was felt to be an object of considerable importance, a stone was procured for each about one foot square and four or five feet long. This was sunk endways until it was level with the ground, and had the word "Station" and the date of the year cut upon it. We did not however rely wholly upon the stone, though its great weight would render its removal a task of some difficulty; each station, wherever practicable, is also fixed by angles formed by steeples or other permanent objects in the vicinity, and by means of which, should the stone be removed, the station may be readily recovered within a very few inches.

SECTION 2.—*Of the method of computation employed.*

A triangle upon the surface of the earth, the sides of which are small in proportion to the radius, may be considered as a spherical triangle, and the sides may be computed by means of spherical trigonometry. Or, the angles formed by the chords may be calculated, and the spherical triangle be thus reduced

to a plane triangle, of which one of the sides and the angles being known, the other sides or chords may be readily determined. This is the method which has hitherto been employed in the English and Indian geodesical operations.

A third method, which is due to LEGENDRE, is as follows: If from each of the observed angles of a small spherical triangle, one third of the spherical excess be deducted, the sines of the angles thus diminished will be proportional to the lengths of the opposite sides, so that the triangle may be resolved as if perfectly rectilineal. This method, which is beautifully simple and accurate, is usually employed on the continent, and is that of which I shall avail myself on the present occasion.

The excess of the sum of the three angles of a spherical triangle above two right angles, termed the spherical excess, is useful to indicate the degree of reliance which may be placed upon the observed angles. I have therefore given it in a separate column, from which the sum of the errors of the observed angles of any one of the triangles may readily be inferred. It is also necessary, when only two angles of a triangle have been observed, that the spherical excess should be known, in order that one third of it may be deducted from each of these angles to prepare them for calculation. The spherical excess of a triangle may be found in seconds, by adding together the logarithm of any two sides, the logarithmic sine of the contained angle, and the constant logarithm 0.3733260.

SECTION 3.—*Triangles and distances.*

The distance given by General ROY from his station upon Severndroog Castle to that upon Hanger Hill Tower, is 84376.68 feet; but the distance from the station of 1822 upon Severndroog Castle to General ROY's station was $10\frac{7}{8}$ inches; and the angle between General ROY's station and Hanger Hill being about 47° 23′, we have 0.62 of a foot to be added in order to obtain 84377.3 feet, the distance from the station of 1822 to Hanger Hill.

By the comparison of various British standards of linear measure, published in the Phil. Trans. for 1821, it appears that the standard employed by General ROY for the measurement of the base upon Hounslow Heath differed from the Imperial standard yard; and in consequence it becomes necessary to multiply

General Roy's distance by .0000691 to obtain 5.82, the correction to be added to such distance, in order to convert the feet of his survey into Imperial feet *. Applying this correction, we have 84383.12 for the distance in Imperial feet from Severndroog Castle to Hanger Hill Tower.

	Observed Angles.	Sp. Excess.	Angles for Calculation.	Distances. Feet.
Hanger Hill from Severndroog Castle, 84383.12 feet.				
Leith Hill Station	35° 23′ 13.87″	.....	35° 23′ 13.32″	
Hanger Hill	83 26 23.60	.....	83 26 23.05	127658.21
Severndroog Castle	61 10 24.18	.....	61 10 23.63	144760.96
	180 0 1.65	2.53		
Severndroog Castle from Leith Hill Station, 144760.96 feet.				
Wrotham Station	65° 26′ 47.68″	.....	65° 26′ 46.85″	
Severndroog Castle	86 25 58.40	.....	86 25 57.57	75014.27
Leith Hill Station	28 7 16.42	.....	28 7 15.58	158844.37
	180 0 2.50	2.56		
Wrotham Station from Severndroog Castle, 75014.27 feet.				
Chingford Station	16° 35′ 1.77″	.....	16° 35′ 2.00″	
Severndroog Castle	149 26 13.36	.....	149 26 13.58	63488.87
Wrotham Station	13 58 44.20	.....	13 58 44.42	133640.58
	179 59 59.33	0.97		
Hanger Hill from Leith Hill Station, 127658.21 feet.				
Westminster Abbey	° ′ ″	.....	77° 17′ 27.37″	
Hanger Hill	84 59 56.81	.....	84 59 56.41	39809.02
Leith Hill Station	17 42 36.62	.....	17 42 36.22	130366.27
		1.20		

* The sides of the triangles of the Trigonometrical Survey of Great Britain are, I believe, derived from bases measured by General Roy's standard, and they will therefore require the same correction as that employed above, should it be necessary to convert them into Imperial feet.

Westminster Abbey from Leith Hill Station, 130366.27 feet.

	Observed Angles.	Sp. Excess.	Angles for Calculation.	Distances. Feet.
Severndroog Castle	62° 33′ 57″.67	.....	62° 33′ 57″.22	
Westminster Abbey		.....	99 45 26.38	44601.10
Leith Hill Station	17 40 36.85	.....	17 40 36.40	144759.97
		1.35		

Westminster Abbey from Severndroog Castle, 44601.10 feet.

Chingford Station	42° 52′ 10″.16	.....	42° 52′ 9″.96	
Severndroog Castle.....	61 33 50.95	.....	61 33 50.75	63488.87
Westminster Abbey		.....	75 33 59.29	57648.50
		0.59		

Leith Hill Station from Severndroog Castle, 144760.96 feet.

Westminster Abbey	° ′ ″	.....	99° 45′ 26″.38	
Leith Hill Station	17 40 36.85	.....	17 40 36.40	130367.18
Severndroog Castle.....	62 33 57.67	.....	62 33 57.22	44601.41
		1.35		

Westminster Abbey from Severndroog Castle, 44601.41 feet.

Chingford Station	42° 52′ 10″.16	.....	42° 52′ 9″.96	
Westminster Abbey		.....	75 33 59.29	57648.90
Severndroog Castle	61 33 50.95	.....	61 33 50.75	63489.30
		0.59		

Hanger Hill from Leith Hill Station, 127658.21 feet.

St. Paul's.....	° ′ ″	.....	67° 24′ 58″.34	
Hanger Hill.....	93 13 3.10	.....	93 13 2.63	45848.20
Leith Hill Station	19 21 59.50	.....	19 21 59.03	138042.29
		1.41		

St. Paul's from Leith Hill Station, 138042.29 feet.				
	Observed Angles.	Sp. Excess.	Angles for Calculation.	Distances. Feet.
Severndroog Castle	72 24 29.57	.....	72 24 29.14	
St. Paul's		.....	91 34 15.54	39967.20
Leith Hill Station.....	16 1 15.75	.....	16 1 15.32	144760.30
		1.30		
Severndroog Castle from St. Paul's, 39967.20 feet.				
Chingford Station.....	39 0 36.11	.....	39 0 35.95	
Severndroog Castle.....	51 43 19.05	.....	51 43 18.89	63489.66
St. Paul's		.....	89 16 5.16	49844.30
		0.47		
Leith Hill Station from Severndroog Castle, 144760.96 feet.				
St. Paul's		.....	91 34 15.54	
Leith Hill Station	16 1 15.75	.....	16 1 15.32	138042.86
Severndroog Castle.....	72 24 29.57	.....	72 24 29.14	39967.36
		1.30		
Severndroog Castle from St. Paul's, 39967.36 feet.				
Chingford Station	39 0 36.11	.....	39 0 35.95	
Severndroog Castle.....	51 43 19.05	.....	51 43 18.89	63489.91
St. Paul's		.....	89 16 5.16	49844.50
		0.47		

By the preceding triangles we have the following distances from Chingford to Severndroog Castle.

63488.87
63488.87
63489.30
63489.66
63489.91

Mean 63489.32

Mean distance of Severndroog Castle from Chingford Station, 63489.32 feet.				
	Observed Angles.	Sp. Excess.	Angles for Calculation.	Distances. Feet.
	° ′ ″		° ′ ″	
Royal Observatory		.....	106 13 13.67	
Severndroog Castle	60 55 21.23	.....	60 55 21.17	14713.21
Chingford Station	12 51 25.22	.....	12 51 25.16	57787.63
		0.19		

To connect the centre of the transit instrument at the Royal Observatory with the preceding triangle, the Astronomer Royal favoured me with the data given in Plate X. fig. 1. It may there be seen that the distance from the centre of the octagon room to the centre of the transit is 105.89 feet, the angle at the transit between the octagon room and the meridian of Greenwich 55° 25′ 33″.6, and that the length of a perpendicular let fall from the centre of the octagon room upon the meridian of Greenwich is 87.19 feet. By means of these data and the distance from the centre of the octagon room to Chingford Station, the angle at Chingford Station between the centre of the octagon room and the centre of the transit, is found to be 5′ 11″.21.

If any proof were necessary of the accuracy of the preceding data, I might observe that in the account of General Roy's survey, a plan is given of the Royal Observatory at Greenwich, in which I find the distance from the octagon room to the centre of the transit, and the angle it forms with the meridian, to agree as nearly as possible with the measurements given to me by the Astronomer Royal.

Chingford Station from the Royal Observatory, 57787.63 feet.				
	Observed Angles.	Sp. Excess.	Angles for Calculation.	Distances. Feet.
			° ′ ″	
Centre of Transit.....	————	.....	55 25 33.6	
Chingford Station	————	.....	0 5 11.21	57847.66
Royal Observatory	————	.....	124 29 15.19	105.89

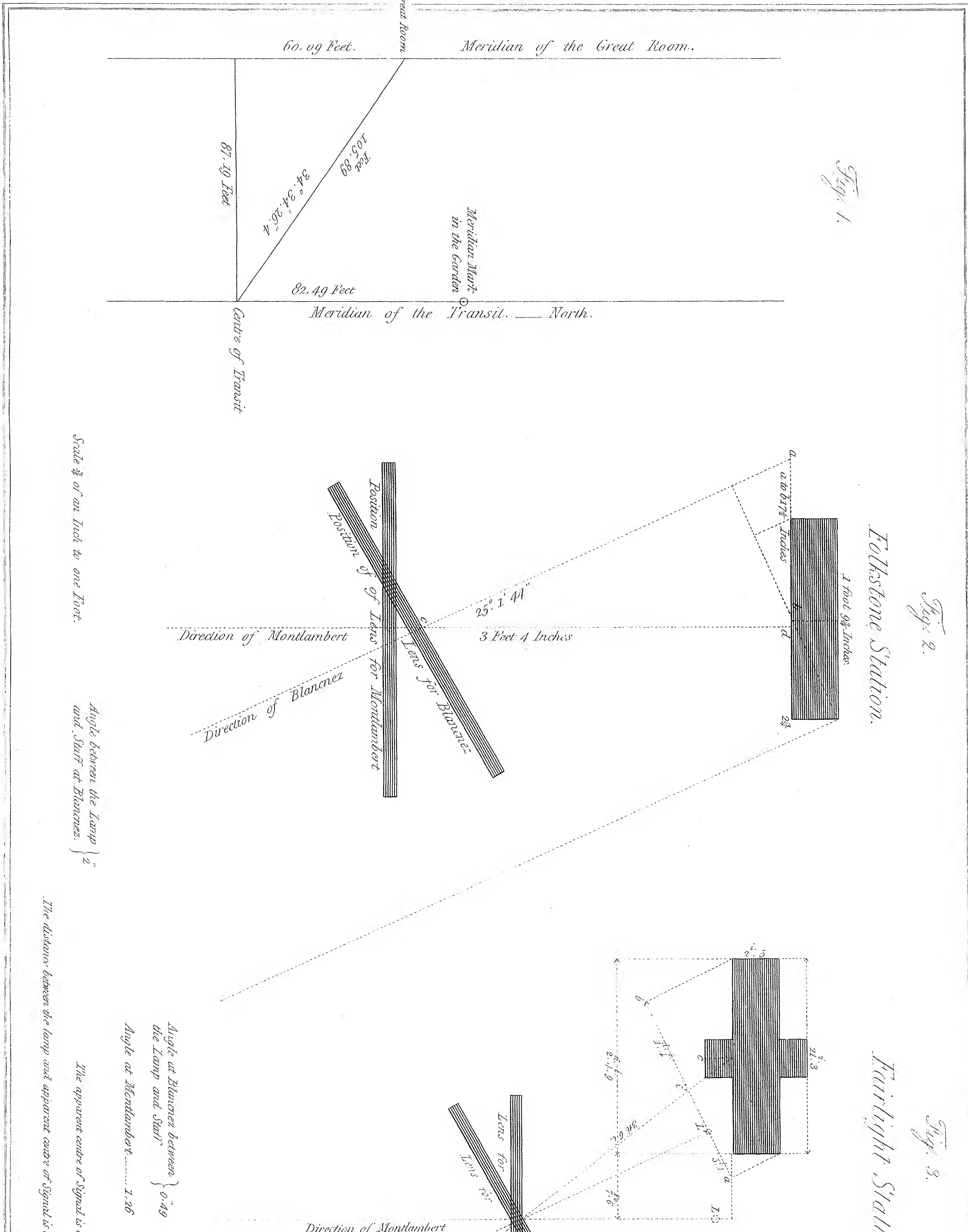


Fig. 1.
Centre of Great Room
60.09 Feet.
Meridian of the Great Room.
87.19 Feet
105.89 Feet
34°.34'.26".4
Meridian Mark in the Garden
82.49 Feet
Meridian of the Transit. ___ North.
Centre of Transit
Fig. 2.
Folkstone Station.
a to b 17½ Inches
1 Foot 9¾ Inches.
a
b
d
c
2¾
Position of Lens for Montlambert
Position of Lens for Blancnez
25° 1' 44"
Direction of Montlambert
3 Feet 4 Inches
Direction of Blancnez
Scale ¾ of an Inch to one Foot.
Angle between the Lamp and Staff at Blancnez. } 2"
Fig. 3.
Fairlight Station.
Lens for Montlambert
Lens for Blancnez
Direction of Montlambert
Direction of Blancnez
Angle at Blancnez between the Lamp and Staff } 0".49
Angle at Montlambert 1.26
The apparent centre of Signal is at { Montlambert as in c; Blancnez is in c middle of a b
The distance between the lamp and apparent centre of Signal is at { Montlambert I. C = 18.2; Blancnez I. C = 5.4

With the distance 63489.32 feet, of Chingford Station from Severndroog Castle, the distance 57847.66 feet, from Chingford Station to the centre of the transit, and the contained angle 12° 46′ 13″.95, we obtain the angles and distance given in the following triangle.

	Observed Angles.	Sp. Excess.	Angles for Calculation.	Distances. Feet.
Severndroog Castle.....	————	.....	61° 3′ 9″.56	
Centre of Transit.....	————	.....	106 10 36.48	14612.73
Chingford Station	————	.....	12 46 13.95	————

The distance given by General Roy from the centre of the transit to his station on Severndroog, is . . . . . 14610.58 feet.
Add for difference of stations 0.62
Add to convert into Imperial feet 1.01

General Roy's distance in Imperial feet 14612.21
Distance above given 14612.73

Difference 0.52

Leith Hill Station from Wrotham Station, 158844.37 feet.

	Observed Angles.	Sp. Excess.	Angles for Calculation.	Distances. Feet.
Crowborough Station	87° 5′ 15″.01	.....	87° 5′ 14″.32	
Leith Hill Station	38 56 55.95	.....	38 56 55.25	128615.26
Wrotham Station.....	53 57 51.13	.....	53 57 50.43	99982.55
	180 0 2.09	3.03		

Wrotham Station from Crowborough Station, 99982.55 feet.

Stede Hill Station	44° 44′ 52″.83	.....	44° 44′ 51″.73	
Crowborough Station	41 58 20.94	.....	41 58 19.84	141790.75
Wrotham Station.....	93 16 49.54	.....	93 16 48.43	94980.95
	180 0 3.31	2.24		

Stede Hill Station from Crowborough Station, 141790.75 feet.				
	Observed Angles.	Sp. Excess.	Angles for Calculation.	Distances. Feet.
Fairlight Station.....	65 ° 2 ′ 35.83	.....	65 ° 2 ′ 34.54	
Stede Hill Station	53 13 24.33	.....	53 13 23.05	137745.52
Crowborough Station.....	61 44 3.69	.....	61 44 2.41	125267.46
	180 0 3.85	3.70		
Stede Hill Station from Fairlight Station, 137745.52 feet.				
Tolsford Station.....	69 ° 7 ′ 58.69	.....	69 ° 7 ′ 57.10	
Fairlight Station.....	45 27 54.39	.....	45 27 52.81	134038.00
Stede Hill Station	65 24 11.67	.....	65 24 10.09	105080.02
	180 0 4.75	3.11		
Wrotham Station from Crowborough Station, 99982.55 feet.				
Fairlight Station.....	33 ° 6 ′ 31.28	.....	33 ° 6 ′ 29.69	
Wrotham Station	43 11 8.83	.....	43 11 7.27	177831.03
Crowborough Station.....	103 42 24.66	.....	103 42 23.04	125267.87
	180 0 4.77	2.87		
Crowborough Station from Fairlight Station, 125267.87 feet.				
Stede Hill Station	53 ° 13 ′ 24.33	.....	53 ° 13 ′ 23.05	
Crowborough Station.....	61 44 3.69	.....	61 44 2.41	141791.20
Fairlight Station.....	65 2 35.83	.....	65 2 34.54	137745.95
	180 0 3.85	3.70		
Stede Hill Station from Fairlight Station, 137745.95 feet.				
Tolsford Station.....	69 ° 7 ′ 58.69	.....	69 ° 7 ′ 57.10	
Stede Hill Station	65 24 11.67	.....	65 24 10.09	105080.36
Fairlight Station.....	45 27 54.39	.....	45 27 52.81	134038.43
	180 0 4.75	3.11		

Wrotham Station from Stede Hill Station, 94980.95 feet.				
	Observed Angles.	Sp. Excess.	Angles for Calculation.	Distances. Feet.
Fairlight Station.....	31° 56′ 2.49″	.....	31° 56′ 2.41″	
Wrotham Station	50 5 40.62	.....	50 5 40.54	177832.66
Stede Hill Station	97 58 17.13	.....	97 58 17.05	137747.27
		3.06		
Stede Hill Station from Fairlight Station, 137747.27 feet.				
Tolsford Station.....	69° 7′ 58.69″	.....	69° 7′ 57.10″	
Stede Hill Station	65 24 11.67	.....	65 24 10.09	105081.36
Fairlight Station.....	45 27 54.39	.....	45 27 52.81	134039.68
	180 0 4.75	3.11		

The preceding triangles give three distances from Tolsford to Fairlight, derived from the three sides of the triangle; Stede Hill, Wrotham, Crowborough,—viz.

134038.00 feet.
134038.43
134039.68

Mean 134038.70

Mean distance Tolsford Station from Fairlight Station, 134038.70 feet.				
	Observed Angles.	Sp. Excess.	Angles for Calculation.	Distances. Feet.
Crowborough Station.....	36° 5′ 24.01″	.....	36° 5′ 23.75″	
Tolsford Station.....	33 24 6.89	.....	33 24 6.63	213125.73
Fairlight Station.....	110 30 29.88	.....	110 30 29.62	125267.72
	180 0 0.78	3.72		
Mean distance Stede Hill Station from Tolsford Station, 105080.58 feet.				
Crowborough Station.....	25° 38′ 39.85″	.....	25° 38′ 37.62″	
Stede Hill Station	118 37 36.34	.....	118 37 34.12	141791.16
Tolsford Station.....	35 43 50.48	.....	35 43 48.26	213127.05
		3.09		

Mean distance Tolsford Station from Fairlight Station, 134038.70 feet.				
	Observed Angles.	Sp. Excess.	Angles for Calculation.	Distances. Feet.
Folkstone Station	° ′ ″ 36 17 57.06	.....	° ′ ″ 36 17 56.85	
Tolsford Station.....	136 51 46.61	.....	136 51 46.41	26957.63
Fairlight Station....	6 50 16.94	.....	6 50 16.74	154811.39
	180 0 0.61	0.58		
Folkstone Station from Fairlight Station, 154811.39 feet.				
Dungeness Light-House ..	° ′ ″	.....	° ′ ″ 136 55 5.46	
Folkstone Station	21 14 49.48	.....	21 14 49.11	84298.42
Fairlight Station.....	21 50 5.80	.....	21 50 5.43	82135.35
		1.12		

The following triangles connect our work with the stations on the French coast.

Tolsford Station from Fairlight Station, 134038.70 feet.				
	Observed Angles.	Sp. Excess.	Angles for Calculation.	Distances. Feet.
Montlambert Station.....	° ′ ″ 32 53 2.05	.....	° ′ ″ 32 53 0.13	
Tolsford Station.....	95 48 2.05	.....	95 48 0.12	192717.35
Fairlight Station.....	51 19 1.68	.....	51 18 59.75	245616.17
	180 0 5.78	6.07		
Fairlight Station from Montlambert Station, 245616.17 feet.				
Blancnez Station.....	° ′ ″ 75 56 24.49	.....	° ′ ″ 75 56 23.57	
Fairlight Station	17 39 26.36	.....	17 39 25.44	252702.93
Montlambert Station	86 24 11.91	.....	86 24 10.99	76800.92
	180 0 2.76	4.45		
Tolsford Station from Montlambert Station, 192717.35 feet.				
Blancnez Station.....	° ′ ″ 103 42 5.81	.....	° ′ ″ 103 42 4.96	
Tolsford Station	22 46 47.48	.....	22 46 46.64	159493.81
Montlambert Station	53 31 9.25	.....	53 31 8.40	76803.37
	180 0 2.54	2.81		

Tolsford Station from Fairlight Station, 134038.70 feet.				
	Observed Angles.	Sp. Excess.	Angles for Calculation.	Distances. Feet.
Blancnez Station	° ′ ″ 27 45 39.99	.....	° ′ ″ 27 45 38.34	
Tolsford Station.....	118 34 48.97	.....	118 34 47.32	159500.18
Fairlight Station.....	33 39 35.99	.....	33 39 34.34	252708.40
	180 0 4.95	4.44		
Tolsford Station from Blancnez Station, 159500.18 feet.				
Montlambert Station.....	° ′ ″ 53 31 9.25	.....	° ′ ″ 53 31 8.40	
Tolsford Station.....	22 46 47.48	.....	22 46 46.64	192725.04
Blancnez Station	103 42 5.81	.....	103 42 4.96	76806.43
	180 0 2.54	2.81		
Fairlight from Blancnez Station, 252708.40 feet.				
Montlambert Station.....	° ′ ″ 86 24 11.91	.....	° ′ ″ 86 24 10.99	
Fairlight Station.....	17 39 26.36	.....	17 39 25.44	245621.50
Blancnez Station	75 56 24.49	.....	75 56 23.57	76802.60
	180 0 2.76	4.45		
Folkstone Station from Fairlight Station, 154811.39 feet.				
Montlambert Station.....	° ′ ″ 38 44 53.42	.....	° ′ ″ 38 44 51.92	
Folkstone Station	96 46 26.32	.....	96 46 24.83	173300.64
Fairlight Station.....	44 28 44.74	.....	44 28 43.25	245618.40
	180 0 4.48	6.29		
Fairlight Station from Montlambert Station, 245618.40 feet.				
Blancnez Station	° ′ ″ 75 56 24.49	.....	° ′ ″ 75 56 23.57	
Fairlight Station.....	17 39 26.36	.....	17 39 25.44	252705.23
Montlambert Station.....	86 24 11.91	.....	86 24 10.99	76801.62
	180 0 2.76	4.45		

Folkstone Station from Montlambert Station, 173300.64 feet.				
	Observed Angles.	Sp. Excess.	Angles for Calculation.	Distances. Feet.
Blancnez Station	107° 18′ 55″.90	.....	107° 18′ 55″.54	
Folkstone Station	25 1 46.69	.....	25 1 46.33	134167.37
Montlambert Station	47 39 18.49	.....	47 39 18.13	76801.57
	180 0 1.08	2.32		
Folkstone Station from Fairlight Station, 154811.39 feet.				
Blancnez Station	31° 22′ 31″.13	.....	31° 22′ 30″.02	
Folkstone Station	121 48 13.55	.....	121 48 12.43	134168.12
Fairlight Station.....	26 49 18.67	.....	26 49 17.55	252705.93
	180 0 3.35	4.17		
Folkstone Station from Blancnez Station, 134168.12 feet.				
Montlambert Station	47° 39′ 18″.49	.....	47° 39′ 18″.13	
Folkstone Station	25 1 46.69	.....	25 1 46.33	173301.60
Blancnez Station	107 18 55.90	.....	107 18 55.54	76802.00
	180 0 1.08	2.32		
Fairlight Station from Blancnez Station, 252705.93 feet.				
Montlambert Station	86° 24′ 11″.91	.....	86° 24′ 10″.99	
Fairlight Station.....	17 39 26.36	.....	17 39 25.44	245619.11
Blancnez Station	75 56 24.49	.....	75 56 23.57	76801.82
	180 0 2.76	4.45		

To show the degree of reliance that may be placed upon the triangles connecting the coasts of England and France, I shall here give the distances resulting from different triangles, derived respectively from the distance Tolsford from Fairlight, and the distance Folkstone from Fairlight.

	By Tolsford from Fairlight.	By Folkstone from Fairlight.
	Feet.	Feet.
Fairlight from Montlambert	245616.17	245618.40
	245621.50	245619.11
Mean	245618.88	245618.75
Fairlight from Blancnez	252702.93	252705.23
	252708.40	252705.93
Mean	252705.66	252705.58
Tolsford from Montlambert	192717.35	
	192725.04	
Mean	192721.19	
Tolsford from Blancnez	159493.81	
	159500.18	
Mean	159496.99	
Folkstone from Montlambert		173300.64
		173301.60
Mean		173301.12
Folkstone from Blancnez		134167.37
		134168.12
Mean		134167.74
Blancnez from Montlambert	76800.92	76801.62
	76803.37	76801.57
	76806.43	76802.00
	76802.60	76801.82
Mean	76803.33	76801.75

Mean distance Folkstone Station from Blancnez Station, 134167.74 feet.				
	Observed Angles.	Sp. Excess.	Angles for Calculation.	Distances. Feet.
	° ′ ″		° ′ ″	
Dover Station.....		.....	117 18 16.41	
Folkstone Station	50 37 50.23	.....	50 37 49.97	31560.06
Blancnez Station	12 3 53.88	.....	12 3 53.62	116726.89
		0.77		

Mean distance Folkstone Station from Blancnez Station, 134167.74 feet.				
	° ′ ″		° ′ ″	
Nôtre Dame, Calais		.....	38 42 1.54	
Folkstone Station	9 21 18.50	.....	9 21 18.23	159605.30
Blancnez Station.....	131 56 40.50	.....	131 56 40.23	34880.94
		0.82		

With the sides "Folkstone to Nôtre Dame, Calais," "Folkstone to Dover," and the included angle 41° 16′ 30″.7, the remaining angles and the distance of Dover Station from Nôtre Dame, Calais, were computed. Also by means of the sides "Blancnez to Dover," "Blancnez to Calais," and the included angle 119° 52′ 50″.32, we obtain another distance from Dover to Nôtre Dame, Calais. These results are contained in the two following triangles:

Folkstone Station from Nôtre Dame, Calais, 159605.30 feet.				
	Observed Angles.	Sp. Excess.	Angles for Calculation.	Distances. Feet.
	° ′ ″		° ′ ″	
Nôtre Dame, Calais		.....	8 42 38.35	
Folkstone Station	41 16 30.70	.....	41 16 30.44	
Dover Station.....		.....	130 0 51.21	137471.95
		0.78		

Dover Station from Blancnez Station, 116726.89 feet.				
	° ′ ″		° ′ ″	
Nôtre Dame, Calais		.....	47 24 37.27	
Blancnez Station.....	119 52 50.32	.....	119 52 50.04	
Dover Station.....		.....	12 42 32.69	137472.03
		0.83		

As two of the angles were observed in the triangle "Fiennes, Montlambert, and Blancnez," and as an opportunity occurred at Tolsford of obtaining the angle between Fiennes and Montlambert, I have added the following triangles connecting these stations:

Mean distance Montlambert from Blancnez, 76802.54 feet.				
	Observed Angles.	Sp. Excess.	Angles for Calculation.	Distances. Feet.
	° ′ ″		° ′ ″	
Fiennes		.....	94 10 48.60	
Montlambert	34 27 39.83	.....	34 27 39.62	60148.31
Blancnez.....	51 21 31.99	.....	51 21 31.78	43574.27
		0.62		
Mean distance Montlambert from Tolsford 192721.19 feet.				
	° ′ ″		° ′ ″	
Fiennes		.....	74 30 57.26	
Montlambert	87 58 48.81	.....	87 58 47.90	60148.74
Tolsford	17 30 15.75	.....	17 30 14.84	199855.18
		2.72		

With the sides "Blancnez from Nôtre Dame, Calais," "Blancnez from Fiennes," and the contained angle, we obtain the distance from Fiennes to Nôtre Dame, Calais.

Fiennes from Blancnez, 43574.27 feet.				
	Observed Angles.	Sp. Excess.	Angles for Calculation.	Distances. Feet.
	° ′ ″		° ′ ″	
Nôtre Dame, Calais		.....	64 24 14.39	
Fiennes		.....	46 12 52.27	45221.01
Blancnez.....	69 22 53.45	.....	69 22 53.34	
		0.34		

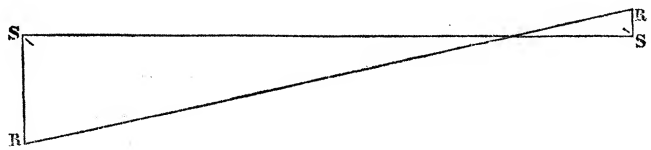
As we thought it desirable to compare General Roy's operations with our own, staffs were erected upon his stations on Tenterden, Frant, Goudhurst and

Lydd steeples; but of these we were able to connect only Frant and Tenterden with our work. The results are as follow:

Tolsford from Fairlight, 134038.70 feet.				
	Observed Angles.	Sp. Excess.	Angles for Calculation.	Distances. Feet.
	° ′ ″		° ′ ″	
Tenterden Church		.....	110 42 17.46	
Tolsford	29 58 10.86	.....	29 58 10.38	90809.26
Fairlight	39 19 32.64	.....	39 19 32.16	71580.75
		1.44		
Fairlight from Crowborough, 125267.72 feet.				
	° ′ ″		° ′ ″	
Frant Church		.....	104 44 17.92	
Fairlight	13 44 20.24	.....	13 44 19.97	113857.34
Crowborough	61 31 22.38	.....	61 31 22.11	30762.92
		0.80		

In a former part of this paper I have mentioned that General Roy's station at Folkstone was discovered at the distance of three feet to the North-west of the new station; the angle between his station at Folkstone and our station at Fairlight being 80° 13′.

At Fairlight, General Roy's station was 87.69 feet to the South-east; the angle between his station and Folkstone being 89° 14′ 31″. The relative positions of the several stations will be better understood from the following diagram,

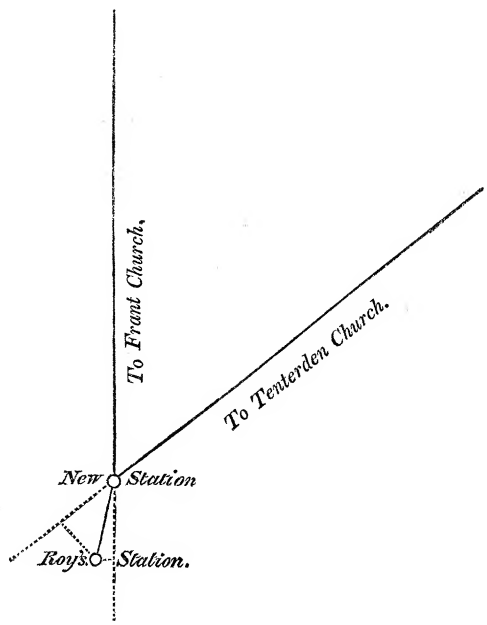


in which R and R designate General Roy's stations, and S and S those of the present operations. From these data the computed distance between General Roy's stations at Fairlight and Folkstone is 154807.00 feet.

We have now several distances which we may compare with those given by General Roy.

The distance from Frant Church to Fairlight is stated by General Roy to be 113928.20 feet. Now if we suppose the distance from Frant to Fairlight to be prolonged, we have the angle between this prolongation and General Roy's station 12° 50′ 56″; and multiplying 87.69 feet, the distance from the new station to that of General Roy, by the cosine of this angle, we obtain 85.48 feet to be subtracted from General Roy's distance, to reduce it to the new station. The distance thus obtained is 113842.72 feet.

In like manner, multiplying 87.69 feet by the cosine of 44° 35′ 41″.75, (the angle between General Roy's station and the prolongation of the distance from Tenterden Church,) we obtain 62.44 feet; which being subtracted from 71634.73 feet, the distance from General Roy's station to Tenterden, will give 71572.29 feet, according to General Roy, for the distance from Tenterden to the new station, without sensible error. The following diagram may serve to render this more intelligible.



General Roy did not obtain directly the distance between his stations at Folkstone and Fairlight; but by using the distances Paddlesworth to Folkstone, Paddlesworth to Fairlight, and the included angle 117° 45′ 42″.65, we are enabled to supply this omission; and we thus obtain 154792.00 feet

for General Roy's distance from Fairlight to Folkstone.—We have also the distance from Dover Castle station to Nôtre Dame, Calais, according to General Roy, 137449.90 feet.

Lastly, The distance from Nôtre Dame, Calais, to Fiennes is given by General Roy, using his own observations, and the angles observed by the French: this distance is stated to be 45219.60 feet.

Converting General Roy's distances into Imperial feet in the manner formerly stated, we have the following results:

From	By General Roy.	By the present Operations.	Difference.
	Feet.	Feet.	Feet.
Fairlight to Frant	113850.59	113857.34	6.75
Fairlight to Tenterden	71577.24	71580.75	3.51
Fairlight to Folkstone.....	154802.70	154807.00	4.30
Dover to Nôtre Dame, Calais..	137459.40	137471.99	12.59
Nôtre Dame, Calais, to Fiennes	45222.72	45221.01	1.71

Section 4.—*Of the distances from the meridian, and from the perpendicular to the meridian, of Greenwich.*

It has been mentioned that the station at Chingford was the spot where the temporary meridian mark was erected. This being removed, a staff was put up in its place, having a triangular board fastened to it, the base of which was parallel to the horizon, and the vertex coinciding with the staff.

As it was highly important to ascertain with the greatest precision the situation of this staff with respect to the meridian of Greenwich, Mr. Gardner went to the Royal Observatory, in order to observe it with the transit instrument. He found that the middle wire of the transit appeared to touch one of the angles at the base of the triangular board, and that the vertex was to the West of the meridian. The angular distance from the meridian to the staff was then measured by means of the micrometer of the transit instrument, and found to be thirty-seven divisions of the micrometer, or $6''.16$, &c.

By means of the roughly computed distance from the Royal Observatory to Chingford, and its angle with the meridian, the distance of the station from the meridian of Greenwich was found to be 20 inches; and the base of the triangular board proved on measurement to be exactly double that quantity.

When the theodolite was put up at Chingford, the distance of twenty inches was measured to the eastward from the line joining the Station and the Royal Observatory, and an Argand's lamp was placed upon this spot, the position of which I requested the Astronomer Royal to observe. In the Greenwich observations for 1822 I find accordingly, under November 15th, the following remark:—"Observed Captain KATER's light apparently about the thickness of the wire to the west of the meridian." This affords, it is presumed, a sufficient proof that the direction of the station at Chingford, with respect to the meridian of Greenwich, has been accurately determined.

If we suppose a parallel to the meridian of Greenwich and to its perpendicular to be drawn through each station contained in the left-hand column of the following Table, we have the bearings and the distances of the other stations from such parallels, calculated by means of a right-angled plane triangle, the hypothenuse and one of the angles of which are given to find the two other sides: or, let K be the distance between the given stations; M, the distance from the parallel to the perpendicular; P, the distance from the parallel to the meridian; and θ, the bearing or angle with the parallel to the meridian. Then, $M = K \cdot \cos\theta$, and $P = K \cdot \sin\theta$.

TABLE I.

Stations.	Objects.	Bearings.	Distance from a parallel to the meridian of Greenwich. P. Feet.	Distance from a parallel to the perpendicular to the meridian of Greenwich. M. Feet.
Transit Royal Obs.	Chingford	0° 0′ 6.″17 N.W.	1.73 W.	57847.66 N.
	Severndroog	73 49 29.69 S.E.	14034.28 E.	4070.72 S.
Chingford	Transit Royal Obs.	0 0 6.17 S.E.	1.73 E.	57847.66 S.
	St. Paul's	26 14 15.83 S.W.	22036.04 W.	44708.80 S.
	Westminster Abbey	30 5 49.84 S.W.	28908.97 W.	49876.27 S.
	Severndroog	12 46 20.12 S.W.	14035.98 E.	61918.36 S.
	Wrotham	29 21 22.12 S.E.	65515.51 E.	116479.69 S.
Severndroog	Chingford	12 46 20.12 N.W.	14035.98 W.	61918.36 N.
	Wrotham	43 20 6.54 S.E.	51479.66 E.	54561.77 S.
	Leith Hill	43 5 51.03 S.W.	98906.80 W.	105703.32 S.
	Hanger Hill	75 43 45.34 N.W.	81779.19 W.	20800.79 N.
	Westminster Abbey	74 20 11.75 N.W.	42944.95 W.	12041.68 N.
	St. Paul's	64 29 39.83 N.W.	36072.20 W.	17209.88 N.
Leith Hill	Severndroog	43 5 51.03 N.E.	98906.80 E.	105703.32 N.
	Wrotham	71 13 6.61 N.E.	150386.41 E.	51141.52 N.
	Crowborough	69 49 58.14 S.E.	120729.94 E.	44341.48 S.
	Hanger Hill	7 42 37.81 N.E.	17127.63 E.	126504.06 N.
	Westminster Abbey	25 25 14.03 N.E.	55961.13 E.	117744.81 N.
	St. Paul's	27 4 36.84 N.E.	62835.06 E.	122912.60 N.

TABLE I. (Continued.)

Stations.	Objects.	Bearings.	Distance from a parallel to the meridian of Greenwich. P. Feet.	Distance from a parallel to the perpendicular to the meridian of Greenwich. M. Feet.
Wrotham.....	Leith Hill	71° 13′ 6.″61 S.W.	150386.41 W.	51141.52 S.
	Severndroog	43 20 6.54 N.W.	51479.66 W.	54561.77 N.
	Chingford	29 21 22.12 N.W.	65515.51 W.	116479.69 N.
	Stede Hill	76 1 32.25 S.E.	92169.87 E.	22936.75 S.
	Crowborough	17 15 16.18 S.W.	29656.47 W.	95483.00 S.
Crowborough	Wrotham.....	17 15 16.18 N.E.	29656.47 E.	95483.00 N.
	Stede Hill	59 13 36.02 N.E.	121826.34 E.	72546.24 N.
	Frant	59 26 16.32 N.E.	26489.28 E.	15642.10 N.
	Tolsford	84 52 13.64 N.E.	212272.83 E.	19055.17 N.
	Fairlight	59 2 21.57 S.E.	107419.64 E.	64443.95 S.
	Leith Hill	69 49 58.14 N.W.	120729.94 W.	44341.48 N.
Stede Hill	Crowborough	59 13 36.02 S.W.	121826.34 W.	72546.24 S.
	Wrotham.....	76 1 32.25 N.W.	92169.87 W.	22936.75 N.
	Tolsford	59 23 57.12 S.E.	90446.52 E.	53491.64 S.
	Fairlight	6 0 12.97 S.W.	14407.05 W.	136991.06 S.
Fairlight	Stede Hill	6 0 12.97 N.E.	14407.05 E.	136991.06 N.
	Tenterden	12 8 33.62 N.E.	15056.77 E.	69979.29 N.
	Tolsford	51 28 5.78 N.E.	104853.53 E.	83499.12 N.
	Folkstone	58 18 22.52 N.E.	131724.15 E.	81334.62 N.
	Dungeness Lt. House	80 8 28.69 N.E.	80922.34 E.	14063.10 N.
	Blancnez.....	85 7 40.07 N.E.	251792.52 E.	21463.18 N.
	Montlambert	77 12 54.49 S.E.	239529.39 E.	54353.08 S.
	Crowborough	59 2 21.57 N.W.	107419.64 W.	64443.95 N.
	Frant	45 18 1.60 N.W.	80930.37 W.	80086.04 N.
Tolsford	Fairlight.....	51 28 5.78 S.W.	104853.53 W.	83499.12 S.
	Tenterden	81 26 16.16 S.W.	89797.20 W.	13519.92 S.
	Crowborough	84 52 12.41 S.W.	212272.68 W.	19056.45 S.
	Stede Hill	59 23 57.12 N.W.	90446.52 W.	53491.64 N.
	Folkstone	85 23 40.63 S.E.	26870.59 E.	2164.49 S.
	Blancnez.....	67 6 41.54 S.E.	146938.81 E.	62034.50 S.
	Fiennes	61 50 9.18 S.E.	176192.20 E.	94331.42 S.
	Montlambert	44 19 54.34 S.E.	134672.78 E.	137854.54 S.
Folkstone	Tolsford	85 23 40.63 N.W.	26870.59 W.	2164.49 N.
	Dover	65 52 20.12 N.E.	28802.86 E.	12900.88 N.
	Nôtre Dame, Calais	72 51 8.14 S.E.	152510.49 E.	47057.49 S.
	Blancnez.....	63 29 49.91 S.E.	120068.38 E.	59871.23 S.
	Montlambert	38 28 2.31 S.E.	107805.05 E.	135688.40 S.
	Dungeness Lt. House	37 3 33.04 S.W.	50801.68 W.	67271.43 S.
	Fairlight	58 18 22.52 S.W.	131724.15 W.	81334.62 S.
Montlambert	Fairlight	77 12 54.49 N.W.	239529.39 W.	54353.08 N.
	Tolsford	44 19 54.34 N.W.	134672.78 W.	137854.54 N.
	Folkstone	38 28 2.57 N.W.	107805.22 W.	135688.28 N.
	Blancnez.....	9 11 15.56 N.E.	12262.95 E.	75817.22 N.
	Fiennes	43 38 55.18 N.E.	41516.43 E.	43522.48 N.
Blancnez.....	Montlambert	9 11 16.50 S.W.	12263.29 W.	75817.15 S.
	Fairlight	85 7 40.07 S.W.	251792.52 W.	21463.18 S.
	Tolsford	67 6 41.59 N.W.	146938.81 W.	62034.50 N.
	Folkstone	63 29 49.91 N.W.	120068.38 W.	59871.23 N.
	Dover.....	51 25 56.29 N.W.	91265.50 W.	72772.10 N.
	Nôtre Dame, Calais	68 26 50.32 N.E.	32442.07 E.	12813.75 N.
	Fiennes	42 10 16.34 S.E.	29253.50 E.	32294.72 S.

From the preceding Table the following is derived, containing the distances from the meridian of Greenwich and from its perpendicular.

TABLE II.

Stations.	Distance from the meridian of Greenwich. Feet.		Distance from the perpendicular to the meridian of Greenwich. Feet.	
Chingford	1.73	W.	57847.66	N.
Severndroog Castle	14034.28	E.	4070.72	S.
Severndroog Castle	14034.25	E.	4070.70	S.
St. Paul's	22037.77	W.	13138.86	N.
Westminster Abbey	28910.70	W.	7971.39	N.
Wrotham	65513.78	E.	58632.03	S.
Wrotham	65513.92	E.	58632.48	S.
Hanger Hill Tower	67744.93	W.	16730.08	N.
Westminster Abbey	28910.69	W.	7970.97	N.
St. Paul's	22037.94	W.	13139.17	N.
Leith Hill	84872.54	W.	109774.03	S.
Severndroog Tower	14034.26	E.	4070.71	S.
Crowborough	35857.40	E.	154115.51	S.
Hanger Hill Tower	67744.91	W.	16730.03	N.
Westminster Abbey	28911.41	W.	7970.78	N.
St. Paul's	22037.48	W.	13138.57	N.
Leith Hill	84872.56	W.	109773.77	S.
Stede Hill	157683.72	E.	81569.00	S.
Crowborough	35857.38	E.	154115.25	S.
Wrotham	65513.86	E.	58632.38	S.
Stede Hill	157683.73	E.	81569.14	S.
Frant Church	62346.67	E.	138473.28	S.
Tolsford	248130.22	E.	135060.21	S.
Fairlight	143277.03	E.	218559.33	S.
Leith Hill	84872.55	W.	109773.90	S.
Crowborough	35857.39	E.	154115.31	S.
Wrotham	65513.86	E.	58632.32	S.
Tolsford	248130.25	E.	135060.71	S.
Fairlight	143276.68	E.	218560.13	S.
Stede Hill	157684.40	E.	81568.67	S.
Tenterden Church	158334.12	E.	148580.44	S.
Tolsford	248130.88	E.	135060.61	S.
Folkstone	275001.50	E.	137225.11	S.
Dungeness Light House	224199.23	E.	204496.55	S.
Blancnez	395069.87	E.	197096.55	S.
Montlambert	382806.74	E.	272912.81	S.
Crowborough	35857.71	E.	154115.78	S.
Frant Church	62346.98	E.	138473.69	S.
Fairlight	143276.92	E.	218559.63	S.
Tenterden Church	158333.25	E.	148580.43	S.
Crowborough	35857.77	E.	154116.96	S.
Stede Hill	157683.93	E.	81568.87	S.
Folkstone	275001.04	E.	137225.00	S.
Blancnez	395069.26	E.	197095.01	S.
Fiennes	424322.65	E.	229391.93	S.

TABLE II. (Continued.)

Stations.	Distance from the meridian of Greenwich. Feet.		Distance from the perpendicular to the meridian of Greenwich. Feet.	
Montlambert	382803.23	E.	272915.05	S.
Tolsford	248130.68	E.	135060.56	S.
Dover Castle	303804.13	E.	124324.17	S.
Nôtre Dame, Calais.....	427511.76	E.	184282.54	S.
Blancnez	395069.65	E.	197096.28	S.
Montlambert	382806.32	E.	272913.45	S.
Dungeness Light House....	224199.06	E.	204496.69	S.
Fairlight	143277.12	E.	218559.67	S.
Fairlight	143276.04	E.	218560.69	S.
Tolsford	248132.65	E.	135059.23	S.
Folkstone.....	275000.21	E.	137225.49	S.
Blancnez	395068.38	E.	197096.55	S.
Fiennes.....	424321.86	E.	229391.29	S.
Montlambert	382805.75	E.	272913.25	S.
Fairlight	143276.52	E.	218559.28	S.
Tolsford	248130.48	E.	135061.60	S.
Folkstone.....	275000.91	E.	137224.87	S.
Dover Castle	303803.54	E.	124324.00	S.
Nôtre Dame, Calais.....	427511.11	E.	184282.35	S.
Fiennes.....	424322.54	E.	229390.82	S.

The following Table contains the distance of each Station from the meridian and from the perpendicular to the meridian of Greenwich, obtained by taking the mean of the distances given in the preceding Table.

TABLE III.

Stations.	Distance from the meridian of Greenwich. Feet.		Distance from the perpendicular to the meridian of Greenwich. Feet.	
Westminster Abbey.....	28910.93	W.	7971.05	N.
St. Paul's	22037.73	W.	13138.87	N.
Hanger Hill Tower.....	67744.92	W.	16730.05	N.
Chingford.....	1.73	W.	57847.66	N.
Centre of Transit, Royal Obs.				
Severndroog Castle.....	14034.26	E.	4070.71	S.
Wrotham	65513.85	E.	58632.80	S.
Stede Hill.....	157683.94	E.	81568.92	S.
Leith Hill.....	84872.55	W.	109773.90	S.
Dover Castle.....	303803.83	E.	124324.08	S.
Tolsford	248130.86	E.	135060.49	S.
Folkstone.....	275000.91	E.	137225.12	S.
Frant Church	62346.83	E.	138473.48	S.
Tenterden Church	158333.68	E.	148580.43	S.
Crowborough	35857.53	E.	154115.76	S.
Nôtre Dame, Calais.....	427511.43	E.	184282.44	S.
Blancnez	395069.29	E.	197096.10	S.
Dungeness Light House....	224199.14	E.	204496.62	S.
Fairlight	143276.72	E.	218559.79	S.
Fiennes.....	424322.35	E.	229391.35	S.
Montlambert	32805.518	E.	272913.64	S.

SECTION 5.—*Of the latitudes and longitudes of the Stations.*

If the earth were a sphere of known diameter, the latitude and longitude of any point upon its surface might readily be calculated by spherical trigonometry. But the earth being an ellipsoid, other methods of computation involving the eccentricity become necessary. This subject has engaged the attention of the most eminent mathematicians, and various formulæ have been given for the purpose of facilitating such computations. These, though equal in accuracy, differ much in practical convenience; and by far the most manageable that I have met with, and of which I shall avail myself on the present occasion, are to be found in a memoir by ORIANI, but little known I believe in England, which he published at Milan in 1826, under the title of "Opusculi Astronomici *."

Let a, be the semi-major axis of the earth, = 3962.439 miles.

b, the semi-minor axis.

e, the eccentricity of the earth $= \sqrt{\frac{a^2-b^2}{a^2}}$.

M, the distance in feet from the perpendicular to the meridian at Greenwich.

P, the distance in feet from the meridian of Greenwich.

$m, = \frac{\mathrm{M}}{b \sin 1''}$.

$p, = \frac{\mathrm{P}}{b \sin 1''}$.

L, the latitude of Greenwich.

λ, the latitude of the foot of the perpendicular let fall from the given station on the meridian of Greenwich.

φ, the required latitude of the given station.

u, the required longitude of the given station.

Then I) $$\lambda = \mathrm{L} \pm m \left[1 - e^2 + \frac{3}{2} e^2 \cos^2 \left(\mathrm{L} \pm \frac{m}{2}\right)\right]$$

II) $$\psi = p \left(1 - e^2 \sin^2 \lambda\right)$$

III) $$\sin \varphi = \sin \lambda \cos \psi$$

IV) $$\tan u = \frac{\tan \psi}{\cos \lambda} \left(1 - \frac{e^2}{2} \cos^2 \lambda\right)$$

* I am indebted for my knowledge of this work to the valuable journal of Baron ZACH.

In computing the eccentricity I have supposed the compression to be $\frac{1}{300}$, and I have assumed this (which perhaps for our portion of the meridian may not be very far from the truth), because it is nearly the mean between $\frac{1}{310}$ and $\frac{1}{289}$, the limits between which I believe the ellipticity is generally supposed to be comprised.

Table of Latitudes and Longitudes.

Stations.	Latitude.	Longitude.	Longitude in Time.
	° ′ ″	° ′ ″	m s
Chingford Station	51 38 9.59	0 0 0 W.	
Hanger Hill Tower.....	51 31 22.65	0 17 51.28 W.	1 11.42
St. Paul's (Cross).....	51 30 48.42	0 5 48.42 W.	0 23.24
Westminster Abbey (north-west Pinnacle)	51 29 57.34	0 7 36.95 W.	0 30.46
Centre of Transit, Royal Observatory	51 28 38.96	———	———
Severndroog Castle.....	51 27 58.74	0 3 41.64 E.	0 14.77
Wrotham Station.....	51 18 59.35	0 17 11.33 E.	1 8.75
Stede Hill Station	51 15 7.00	0 41 18.86 E.	2 45.26
Leith Hill Station	51 10 34.00	0 22 12.01 W.	1 28.80
Dover Castle Station	51 7 45.59	1 19 23.45 E.	5 17.55
Tolsford Station	51 6 8.65	1 4 48.19 E.	4 23.21
Frant Church	51 5 51.82	0 16 16.84 E.	1 5.12
Folkstone Station.....	51 5 43.18	1 11 48.61 E.	4 47.24
Tenterden Church	51 4 5.95	0 41 19.20 E.	2 45.27
Crowborough Station	51 3 18.30	0 9 21.45 E.	0 37.43
Church of Nôtre Dame, Calais	50 57 27.95	1 51 18.73 E.	7 25.24
Blancnez Station	50 55 29.36	1 42 47.45 E.	6 51.16
Dungeness Light House....	50 54 47.00	0 58 18.89 E.	3 53.26
Fairlight Station	50 52 36.88	0 37 14.23 E.	2 28.94
Fiennes Station	50 50 4.00	1 50 11.41 E.	7 20.76
Montlambert Station	50 43 4.41	1 39 9.62 E.	6 36.64

Section 6.—*Observations of the pole star for determining the direction of the meridian.*

The following is the manner in which observations of the pole star have been usually conducted. The greatest elongation of the star and the time of its greatest elongation being computed, the theodolite was carefully levelled, so that the bubble of the level remained stationary during a whole revolution of the instrument. Then, at the time of the greatest elongation, General Roy states "the angle which the star made with the" (referring) "lamp being noted, the telescope removed, and the plane of the instrument being turned 180° or half

round, the telescope replaced and directed again to the star, the difference on the circle was found to be only $1\frac{1}{4}''$. The same method was universally adhered to, in all places where observations of the star were obtained."

General MUDGE, in his account of the Trigonometrical Survey of Great Britain, says: "At the time of the greatest elongation, when the observer was satisfied of the star being properly bisected, another person at the microscope bisected the dot." "The transit was then taken off, and the instrument being turned half round and the telescope replaced, the star was observed again. This precaution was taken to obviate the errors which might arise from the arms of the instrument being out of the parallel with the plane of the circle, owing to any imperfections in the positions of the Y's on which the transit rested. It was however seldom found that a greater difference subsisted between the readings of the opposite microscopes than what might be supposed to be the consequence of a shake in the centre, or errors in division."

A little consideration will show that the method above described, of obviating an error which might arise from the arms of the telescope not being parallel to the plane of the circle, would not be successful except in the case of the vertical axis being strictly perpendicular to the horizon; but then, the error of the arms of the telescope or axis of the transit, (instantly detected by reversing the level,) could not well escape notice. There is however another source of inaccuracy to which azimuths by the pole star are liable, and which seems to have been wholly disregarded; I allude to an error of the line of collimation. The effect of this upon the azimuth in our latitude would be equal to about six tenths of the error of the line of collimation. This error may however be destroyed by inverting the telescope, or placing that end of the axis which was to the east, to the west; and taking a mean of the observations of the star in both positions.

It must be evident that in taking the greatest elongation of the pole star, the observer is most inconveniently pressed for time; for the azimuth then varies about $1''$ in four minutes; and besides this, should a passing cloud obscure the star, the observation for that day is lost; consequently by this method of proceeding, a long period is necessary before the direction of the meridian can be obtained.

At Blancnez the weather was so tempestuous that the attempt to deduce

the direction of the meridian in the usual way appeared hopeless, and it occurred to me that it would be a far preferable method to note the time at the moment of observing the star, and thence to calculate the azimuth. I was thus enabled to obtain as many observations as I thought convenient, choosing the time when the star was near its greatest elongation, and when consequently its motion in azimuth was the slowest.

The method pursued was the following:—The instrument being very carefully levelled, some terrestrial object was observed. The telescope was then directed to the pole star, and the star being bisected and the time noted, the microscopes were read off. Several observations of the star having been thus made, the telescope was taken out of the Y's and inverted, the end of the axis which was to the east being now turned towards the west, and sometimes, but not always, the circle was turned 180° or half round. Similar observations of the star were then made with the telescope in this position, and lastly the terrestrial object was again observed.

To lessen the labour of computation, the mean of each two successive observations was taken, and from the calculated azimuth of the star the reading at the meridian was deduced. The mean of such readings for each position of the telescope, compared with the reading of the observed terrestrial object, gave the apparent angle of this object with the meridian; and lastly, the mean of the bearing thus obtained in each position of the telescope gave the true bearing.

On the morning of the 2nd October, 1821, the first observations of the pole star were made at Blancnez; but it blew so violently, that from this, or from some other cause which I cannot discover, these observations, though agreeing well among themselves, differ so widely from those made on the evening of the 3rd, under more favourable circumstances, that I have declined employing them.

The object proposed, in observing the direction of the meridian at Crowborough, Fairlight, Tolsford, and Blancnez, was to obtain the longitude of Blancnez independently of any assumed ellipticity of the earth. Crowborough and Tolsford, and Fairlight and Blancnez are also respectively well situated for obtaining the length of a degree perpendicular to the meridian. It is well known, however, that a very small error in the observed direction of the

meridian will produce an error of considerable magnitude in the length of the perpendicular degree;—and we shall ultimately perceive that deductions of this kind from observations of the pole star, appear to be little, if at all, worthy of confidence.

It has been demonstrated that the sum of the three angles upon a sphere and spheroid is so nearly equal, that the difference when the stations are nearly east and west is absolutely insensible. Having, then, the co-latitudes of two stations, with the observed angle at each, between the meridian and the other station, and consequently the sum of these angles, the difference of longitude or the angle at the pole is obtained by the following method:

As the tangent of half the sum of the co-latitudes is to the tangent of half their difference; so is the tangent of half the sum of the observed angles, to the tangent of half their difference.

The triangle is thus reduced to a spherical triangle, in which two angles and two sides are given to find the third angle.

The deductions from the observations detailed in the Appendix are as follow:

Crowborough and Fairlight: distance 125267.72 feet.

At Crowborough, the observed angle between the meridian and Fairlight	121° 4′ 58″.36
At Fairlight, the observed angle between the meridian and Crowborough	58 33 26 .14
The deduced spherical angle at Crowborough	121 13 52 .60
The deduced spherical angle at Fairlight	58 24 31 .90
The resulting difference of longitude	0 27 46 .67

Crowborough and Tolsford: distance 213116.39 feet.

At Crowborough, the observed angle between the meridian and Tolsford	84° 59′ 34″.35
At Tolsford, the observed angle between the meridian and Crowborough	94 17 21 .56
The deduced spherical angle at Crowborough	84 58 27 .84
The deduced spherical angle at Tolsford	94 18 28 .06
The resulting difference of longitude	0 55 21 .39

Fairlight and Blancnez: distance 252705.62 feet.

At Fairlight, the observed angle between the meridian and Blancnez	85° 36′ 39″.73
At Blancnez, (3rd October,) the observed angle between the meridian and Fairlight	93 32 31 .11
The deduced spherical angle at Fairlight	85 35 43 .07
The deduced spherical angle at Blancnez	93 33 27 .77
The resulting difference of longitude	1 5 29

Adding together the longitude of Crowborough and the differences of longitude obtained by means of the azimuths, we have between

Greenwich and Crowborough	0° 9′ 21″.45
Crowborough and Fairlight	0 27 46 .67
Fairlight and Blancnez	1 5 29
Longitude of Blancnez	1 42 37 .12

Differing 10″.33 in defect, from the longitude found by employing $\frac{1}{300}$ as the compression.

Section 7.—*Of the length of the degree upon a circle perpendicular to the meridian.*

I have already remarked that Crowborough and Tolsford, and Fairlight and Blancnez, were respectively very favourably situated for the determination of the length of degrees perpendicular to the meridian at each of these stations: I shall now proceed to state shortly the manner in which the computation was made.

Having obtained by means of the azimuths the difference of longitude, we have a right-angled spherical triangle, the base of which (the co-latitude of the given station,) and the angle at the pole, (the difference of longitude,) are given, to find the perpendicular. Having obtained this arc, we have next to compute the corresponding terrestrial perpendicular. This is effected by means of a small triangle considered as spherical, in which we have the terrestrial distance between the two stations given, and by means of the azimuths two of the angles are deduced. The spherical excess being then computed, and one third subtracted from each of the two angles, the remaining

angle is obtained, and the length of the perpendicular arc in feet is calculated by plane trigonometry.

Lastly, having the perpendicular in arc and also in feet, the number of feet (or fathoms) due to the degree is found by simple proportion.

I shall give the angles of the small triangles used for obtaining the terrestrial perpendicular, in order to facilitate any examination of the work.

At Crowborough.				At Tolsford.			
Crowborough	° ′ ″ 4 0 25.65		° ′ ″ 4 0 25.40	Tolsford	° ′ ″ 4 17 21.56		° ′ ″ 4 17 21.3
Tolsford	85 42 38.44		85 42 38.20	Crowborough	84 59 34.35		84 59 34.1
Remaining∠		″ 0.74	90 16 56.40	Remaining∠		″ 0.80	90 43 4.6
At Fairlight.				**At Blancnez.**			
Fairlight	° ′ ″ 4 23 20.27		° ′ ″ 4 23 19.89	Blancnez	° ′ ″ 3 32 31.11		° ′ ″ 3 32 30.80
Blancnez	86 27 28.89		86 27 28.51	Fairlight	85 36 39.73		85 36 39.42
Remaining∠		″ 1.15	89 9 11.60	Remaining∠		″ 0.93	90 50 49.78

In the manner before explained, we obtain

The perpendicular arc at Crowborough 34′ 47″.84 equal to 212532.00 feet.
The perpendicular arc at Tolsford . . . 34 45 .71 equal to 212329.66 feet.
The perpendicular arc at Fairlight . . . 41 19 .32 equal to 252250.29 feet.
The perpendicular arc at Blancnez . . 41 16 .77 equal to 251991.98 feet.

The length of the degree perpendicular to the meridian at Crowborough . . . . . } 61077 fathoms.
. . . . . at Tolsford . . . . . 61081.3 fathoms.
. . . . . at Fairlight . . . . . 61045 fathoms.
. . . . . at Blancnez . . . . . 61045.3 fathoms.

And taking the means of the latitudes of Crowborough and Tolsford, and of Fairlight and Blancnez, and the means of the respective perpendicular degrees, we have

The perpendicular degree in lat. 51° 4′ 43″.47 = 61079.17 fathoms.
and in lat. 50 54 3 .12 = 61045.15 fathoms.

A moment's examination is sufficient to show that these results are totally unworthy of credit; and that the length of the perpendicular degree above given, must be erroneous about one hundred fathoms.

As very great care was bestowed in making the observations, it is important to determine the degree of error in the azimuth, which would produce an error so considerable, as that which is here indicated.

If $2''$ be added to the azimuth at Crowborough and to that at Tolsford, the resulting difference of longitude would be diminished $5''.14$, and the length of the perpendicular degree would be increased 95 fathoms.

Now an error of two seconds in azimuth may proceed from such a variety of sources, that it is scarcely possible to detect it. I think no one acquainted with the great theodolite would venture to assert that the level and its adjustment comprising that of the Y's, can be depended upon to within two seconds of the truth, and an error of $2''$ in the level would affect the azimuth to the amount of about $2''.3$. This error arising from the level, I have before explained is not to be destroyed by turning the instrument half round; and were there no other source of inaccuracy, I should consider this alone, as an insurmountable objection to the determination of azimuths by means of observations of the pole star.

But in addition to this, the level may be affected by irregular local density. At Arbury Hill (one of the stations of the Trigonometrical Survey of Great Britain), it is known that the plumb-line of the zenith sector was deflected, so as to occasion an anomaly of $5\frac{1}{2}$ seconds in latitude. The same cause of disturbance would equally affect the level, and this admits of no remedy.

To the sources of inaccuracy, before enumerated, may be added a small uncertainty, (the fraction of a second for example,) in the polar distance of the pole star, which would influence the azimuth nearly double that quantity. The possibility, and I might perhaps venture to say the probability, of horizontal refraction, affecting the situation of the terrestrial object to which the star is referred, may also be considered; but this last is common to every method of obtaining the direction of the meridian.

From what has been advanced, it should seem that observations of the pole star, for the purpose of determining the length of the perpendicular degree in

our latitude, are wholly unworthy of credit, and that some other method less liable to error should be employed.

Of these, the best which has occurred to me, is the well known method of observing a star when near the east or west point of the horizon, and from the time and the calculated azimuth to deduce the place of the meridian. Here the alteration of the azimuth from a variation in the refraction, must be carefully taken into account, and the altitude of the star must therefore be obtained.

It will not, however, be necessary to observe the star when *very* near the horizon, as the error in the azimuth arising from the level decreases as the tangent of the altitude, and at an elevation of 12° is scarcely more than two tenths of the error in the horizontality of the axis of the telescope.

Section 8.—*Of the heights of the stations above the level of the sea, and of the terrestrial refraction.*

Let the arc between the two stations be A. The depressions reciprocally observed at the two stations reduced to the height of the axis of the theodolite be D and d; and let R be the mean terrestrial refraction.

Then $R = \frac{A-(D+d)}{2}$. and should one of the stations appear elevated from the other station, calling the elevation E, we have $R = \frac{(A+E)-D}{2}$.

The axis of the instrument was about $5\frac{1}{2}$ feet above the ground, and the angle subtended by this, at the distance between the stations being computed and subtracted from the observed depression, the apparent depression of a point at the height of the axis was obtained. The distance between the stations was converted into arc, by allowing 101.7 feet for each second, and with the arc and the apparent depression, the refraction was computed. The refraction being added to the depression, the difference between this and half the contained arc, gave the angle subtended by the difference in the height of the two stations above the level of the sea; the height of that station being in excess, at which the true depression exceeded one half of the contained arc. Lastly, the angle thus obtained, and the distance between the stations, gave the difference of their heights in feet.

At Folkstone Pier, there is a flag-staff, the height of which was carefully measured, and found to be 37 feet above the Pier. From the pier to the mark on the tide gauge indicating XXI feet, was 5 feet. The harbour master informed me that the highest spring tides rose 20 feet. We have therefore 43 feet from the top of the flag-staff to high water mark, and 63 feet to low water mark.

By means of the side Tolsford from Folkstone in the following triangle, the distances from Folkstone to the flag staff, and from Tolsford to the flag staff were obtained.

	° ′ ″	
Folkstone Pier Flag-staff		
Folkstone station	84 37 49	6152.0 feet.
Tolsford station	13 4 14	27083.6 feet.

With the depression of the summit of the flag-staff, observed at Folkstone and the above data, we obtain the height of the axis of the instrument at Folkstone station above low water mark 559.1 feet.

Similar observations were made at Tolsford, and the resulting height of that station above low water mark differed only 3 feet in defect from that obtained by means of Folkstone. The refraction employed in these computations was $\frac{1}{13.2}$ of the contained arc.

In the following TABLE, are given in one view the data and the computed results.

	Observed Depression or Elevation.	Contained Arc A.	Angle subtended by $5\frac{1}{2}$ feet.	Mean Refraction R	$\frac{1}{\frac{A}{R}}$	Angle of Difference of Height.	Difference of Height. Feet.	Above low Water. Feet.
	° ′ ″	′ ″	′ ″	′ ″		° ′ ″		
Folkstone.....	0 23 37	25 33.1		1 56.1				576.9
Horizon of sea.....								
Folkstone.....	0 10 44.6	25 21.85	0 7.3	1 49.42	$\frac{1}{14}$	+0 0 14.2	10.5	559.1
Fairlight	0 11 13							569.6
Folkstone.....	0 13 50	5 10	0 35.6	0 23·5		+0 11 2.9	101.4	559.1
Dover Castle								457.7
Folkstone.....	0 12 30	21 59	0 8.4	1 39.9		+0 3 2.0	118.4	559.1
Blancnez								440.7
Folkstone.....	4 40 5	1 0.38	3 4.4	0 4.6		+4 36 35	496.1	559.1
Pier Flag Staff.....								63.0

	Observed Depression or Elevation.	Contained Arc A.	Angle subtended by $5\frac{1}{2}$ feet.	Mean Refraction R.	$\frac{1}{\frac{A}{R}}$	Angle of Difference of Height.	Difference of Height. Feet.	Above low Water. Feet.
	° ′ ″	′ ″	′ ″	′ ″		° ′ ″		
Folkstone..... E	0 0 43.75							559.1
		4 25	0 42.0	0 23.9	$\frac{1}{11}$			
Tolsford ..... D	0 5 45					+0 3 14.4	25.4	584.5
Tolsford	0 23 39.7							581.8
		25 36.7		1 57.0				
Horizon of sea.....								
Tolsford	0 6 10							584.5
		17 13	0 10.8	1 36.3	$\frac{1}{11}$			
Stede Hill	0 8 12					+0 1 01.0	31.1	615.6
Tolsford	1 8 22					+1 5 48	518.5	581.5
		4 26.25	0 42.0	0 20.2				
Folkstone Pier Fl. Staff								63.0
Tolsford	0 9 5							584.5
		21 58	0 8.5	2 1.25	$\frac{1}{11}$			
Fairlight	0 9 7.5					+0 0 1.25	0.65	585.2
Fairlight	0 23 48.5							586.7
		25 45.6		1 57.1				
Horizon of sea.....								
Fairlight	0 2 22							577.4
		20 30	0 9.0	1 28.5	$\frac{1}{14}$			
Crowborough	0 15 29					+0 6 33.5	239.0	816.4
Fairlight	0 8 43.5							577.4
		22 34	0 8.2	1 46.45	$\frac{1}{12}$			
Stede Hill	0 10 34					+0 0 55.25	36.9	614.3
Fairlight	0 8 56.5							577.4
		29 8	0 6.3	1 54.55	$\frac{1}{15}$			
Wrotham.....	0 16 35					+0 3 49.25	197.7	775.1
Stede Hill	0 23 56							591.6
		25 53.6		1 57.6				
Horizon of sea.....								
Stede Hill	0 1 0							615.0
		15 34	0 11.9	1 0.4	$\frac{1}{15}$			
Wrotham.....	0 12 57					+0 5 58.5	165.1	780.1
Stede Hill	0 5 24							615.0
		23 14	0 8.0	1 38.5	$\frac{1}{14}$			
Crowborough	0 14 49					+0 4 42.5	194.2	809.2
Crowborough	0 27 58							813.0
		30 15.4		2 17.4				
Horizon of sea.....								
Crowborough	0 4 47.5							812.8
		21 4	0 8.8	1 37	$\frac{1}{13}$			
Leith Hill	0 13 21					+0 4 16.3	159.6	972.4
Crowborough	0 8 9					+0 0 54.7	26.7	812.8
		16 23	0 11.4	1 8.6	$\frac{1}{14}$			
Wrotham.....	0 6 19.5							786.1
Wrotham.....	0 7 15.5							780.4
		26 1	0 7.1	1 51.2	$\frac{1}{14}$			
Leith Hill	0 15 17.25					+0 4 0.8	185.6	966.0
Leith Hill	0 30 42							978.3
		33 12.9		2 30.9				
Horizon of sea.....								
Leith Hill	0 21 47					+0 11 35.7	488.4	966.0
		23 43	0 7.8	1 48				
Severndroog								477.6
Blancnez	0 20 33.3							438.2
		22 14.4		1 41.1				
Horizon of sea.....								

At every station from which the sea was visible, the depression of the horizon

was carefully observed, and the resulting heights will be found in the preceding table. These serve to verify to a certain degree the conclusions otherwise obtained.

The mean of the proportion of the refraction to the contained arc, is $\frac{1}{13.2}$, and this has been employed on every occasion where the refraction was not deduced from reciprocal observations.

I shall now give the elevation of the ground at each station, above the level of the sea at low water, the point chosen by other observers.

	Above low water. Feet.	By depression of horizon.	Difference. Feet.
Folkstone Station ..	553.6	571.4	+17.8
Tolsford Station ..	579.0	576.3	— 2.7
Blancnez	435.2	432.7	— 2.5
Fairlight	572.0	581.2	+ 9.2
Dover Castle Battlements.....	452.2	465.8	
Stede Hill Station ..	609.5	586.1	—23.4
Crowborough Station	807.3	807.5	+ 0.2
Leith Hill Station ..	960.5	972.8	+12 3
Wrotham Station ..	775.0		
Severndroog Castle Battlements	472.1	Mean..	+ 1.5

The mean of the differences is so small that we are authorized to conclude that no error of consequence exists in the heights above given; but as the depressions of the horizon were taken probably in various states of the tide, the mean result should perhaps have differed in defect about 10 feet. This, however, may be fairly attributed to uncertainty in the refraction employed.

In the course of the operations which have been detailed, great pains were taken to identify the stations, by the bearings of such objects as were conveniently situated for the purpose;—these are given in the Appendix.

It is to be regretted that our excellent associate M. Arago has not yet published the results of his operations in France; and I must therefore, in the absence of higher authority, take the longitude of Calais, as given in the Connaissance des Tems, to be 0° 28′ 59″ west of Paris. Adding this to 1° 51′ 18″.73 the east longitude of Calais from Greenwich, given by the present work, we obtain 2° 30′ 17″.73 for the difference of longitude between Paris

and Greenwich. This converted into time is $9^m\ 21^s.18$, differing only $0^s.28$ in defect from the admirable results obtained by the operations with fire signals, reported in the Philosophical Transactions for 1826, by Mr. HERSCHEL.

The truth of the preceding work wholly depends upon the degree of reliance that may be placed upon the base on Hounslow Heath; and as the accuracy of this is in some measure questionable*, it is certainly desirable that a new base should be measured, to connect in the most unexceptionable manner the stations at Leith Hill and Wrotham. The measurement of a base has hitherto not kept pace with the progress of other parts of geodetical operations; but the elegant arrangement which Lieut.-Colonel COLBY has recently imagined for compensating expansion, and which has already been tried in Ireland with perfect success, leaves no doubt of the future accuracy of this most important part of trigonometrical operations.

APPENDIX.

I HAVE reserved for an Appendix such remarks as could not have been introduced in the body of the work, without interrupting the regular connection of its parts.

The original observations are deposited with the Royal Society, and may be consulted whenever occasion may require. It has not been thought necessary to print them, as all the angles employed in this work have been carefully deduced from them, and are given at the end of the present communication. The letter prefixed to each angle indicates the name of the observer; and where the degrees and minutes are repeated, it is to be understood that the instrument has been shifted, and the readings for the angle taken upon different parts of the circle.

The great theodolite had originally only two opposite microscopes, and until the addition I am about to describe was made, the observations were conducted in the following manner.

The instrument being carefully levelled, the objects were intersected, and the microscopes were read off; but it is evident the truth of the angle thus obtained would depend upon the accuracy of the divisions of the circle from

* See Phil. Trans. for 1821, "On the Comparison of various British Standards," &c.

which it was deduced. In order to do away any error of this kind, the whole instrument was shifted by turning it horizontally a few degrees; and being again levelled, the observations were repeated, and the angle was obtained on different parts of the circle. This operation was repeated seldom fewer than eight times, which it was supposed would be sufficient to do away errors of division. Now as at each observation the angle is deduced from readings taken on four different parts of the circle, eight repetitions of this kind would give a mean angle deduced from thirty-two different points of the instrument. The time, however, required for this was so considerable as to constitute a very serious objection; in addition to which, when the instrument had been recently shifted, it was feared the spring of the parts might introduce error. These inconveniences led me to have four additional microscopes fixed to the theodolite, at such distances as with one of the original microscopes to divide the circle into five equal parts. This arrangement of any number of microscopes or verniers which form a prime number, and the manner of using them, is due to Mr. POND the Astronomer Royal, but was never published by him. By means of five microscopes, raising the telescope from the Y's, turning the circle 180° in azimuth, and repeating the observations, the angle is obtained upon twenty different parts of the circle, without shifting the instrument, and consequently any error of division may be supposed to be reduced to a very small quantity. Employing in like manner three equidistant microscopes, the angle is obtained by readings upon twelve different parts of the circle.

The second original microscope was not removed, and this afforded an opportunity of comparing the angles obtained by two opposite microscopes, with those deduced by means of five.

In the course of this work I remarked a curious fact, new to me, and for which I was at a loss to account. In hazy weather when the staff was so faint as to be only just visible, it disappeared upon bringing it to the intersection of the cross wires, so that the angle could not be observed.

A remedy for this inconvenience was suggested and put in practice by Mr. GARDNER. The horizontal spider's web of the micrometer being moved above the centre, Mr. GARDNER succeeded in lodging upon it a very minute particle of dust. When the image of the staff was brought to this, it appeared as if planted upon a mole-hill, and we were thus enabled to observe with great

accuracy. I consider this as a very important improvement in the theodolite, and we availed ourselves of it upon all occasions excepting in the observations of the pole star.

As I was desirous of knowing the degree of precision with which an object could be observed with the telescope of the great theodolite magnifying about fifty times, and also the accuracy with which the microscopes could be read off, as well as the comparative merits of cross wires and Mr. GARDNER's dot, we resolved to make some experiments on the subject. A staff upon a steeple was taken which was faintly seen; Colonel COLBY marked the time occupied by the observations, and Mr. GARDNER read off a certain microscope. The position of the telescope and of the micrometer of the microscope were of course altered between each observation. The following were the results:—

With the Cross Wires.

Time at the commencement ... $0^h\ 43^m$.

Observations.	Readings.	Observations.	Readings.
1.	$35''\frac{3}{4}$	6.	$36''\frac{1}{2}$
2.	$35\ \frac{1}{2}$	7.	$35\ \frac{3}{4}$
3.	$35\ \frac{3}{4}$	8.	$36\ \frac{2}{3}$
4.	$35\ \frac{2}{3}$	9.	$36\ \frac{3}{4}$
5.	$35\ \frac{4}{5}$	10.	$36\ \frac{3}{4}$

Mean ... $36''.03$

Time at the end ... $0^h\ 45^m\ 15^s$.

With Mr. GARDNER'S *Dot.*

Time at the commencement ... $0^h\ 47^m$.

Observations.	Readings.	Observations.	Readings.
1.	$1''\frac{1}{2}$	6.	$1''\frac{7}{8}$
2.	$1\ \frac{3}{4}$	7.	2
3.	$1\ \frac{3}{4}$	8.	$1\ \frac{7}{8}$
4.	2	9.	2
5.	2	10.	$2\ \frac{1}{4}$

Mean ... $1''.9$

Time at the end ... $0^h\ 48^m\ 27^s$.

The time occupied in making ten observations with the cross wires was $2^m\ 15^s$, and the greatest difference from the mean $0''.72$.

The time required for ten observations with Mr. GARDNER's dot was $1^m\ 27^s$, and the greatest difference from the mean only $0''.4$.

These experiments appear to be important; they seem to show that in any single observation the combined errors of the telescope and microscopes cannot exceed, when the cross wires are employed, three quarters of a second, and when Mr. GARDNER's dot is used, they amount only to four-tenths of a second. The time, too, required for the latter observations is little more than half of that which is requisite for the former.

Much error has been supposed to arise both in astronomical and geodetical observations, from unequal expansion of the limb of the instrument. In order

to bring this to the test of experiment, the index of one of the microscopes was placed at zero, and a certain division on the circle brought to its wire. The other microscopes were then read off, the divisions under them having been carefully bisected, and the mean was registered. A piece of lead was placed in boiling water until it acquired the same temperature; and it was then laid upon the limb of the instrument, between two of the microscopes. Having allowed some time to elapse, the first division was again brought to the zero microscope, and the other divisions bisected by their respective micrometers; when the readings were found to be very different, but the mean varied little from the mean first taken. These experiments were repeated with the same results, and satisfactorily proved that no error of consequence is to be feared from unequal expansion of the circle when several microscopes are employed.

Very different, however, was the consequence of applying the hand to any one of the radii to which the microscopes were attached. Then, the expansion which took place immediately and to a very considerable degree, affected the mean of the readings, by altering the position of the microscope to the support of which the hand had been applied.

From these experiments we may infer the very great importance of securing the permanent respective positions of the microscopes. Perhaps this might be best effected by imitating the principle of the mural circle. In this instrument the microscopes are firmly attached to a wall, and any sensible change in their relative positions can scarcely be imagined to take place. In like manner the microscopes of portable instruments might be fixed to a solid plate of metal; and this being a good conductor of heat, should any partial change of temperature take place it is probably to be expected that it would be so rapidly diffused throughout the whole mass as to occasion no perceptible change in the relative distances of the microscopes from each other *.

During our stay at Fairlight, a source of error was remarked which it may

* In instruments constructed in the usual manner, where the microscopes are attached to arms or radii, these may be covered to some thickness by strips of flannel or leather, and thus the ill consequences to be apprehended from currents of air of different temperatures may, perhaps, be avoided. The great theodolite was treated in this manner; but as this was done at Chingford, the last station we visited, no opportunity was afforded of remarking the effect.

be important to mention. An object having been carefully bisected by moving the tangent screw slowly in one direction, and the microscopes read off, the result was found to differ three seconds from that obtained when the tangent screw was moved slowly in the opposite direction. This could arise only from friction upon the axis, and the yielding of the radii of the circle, when drawn by the tangent screw clamped to its circumference. Numerous experiments were made with similar results; so that the force thus applied to the circumference of the circle, occasioned an error of one second and a half, plus or minus, according to the direction in which the tangent screw was made to act.

On shaking the screw, if I may so express myself, backwards and forwards with little jerks, before the object was finally bisected, the error just described was obviated. It would perhaps, however, be preferable, instead of giving motion to the instrument by means of a tangent screw acting on the circumference of the circle, to have a bar, connected at one end with a tangent screw, and a collar at the other end passing round the axis, to which it might be clamped at pleasure. The axis would then be the first part moved, and the probable error arising from dragging the instrument round by the limb would be avoided. This arrangement seems to be particularly called for in circles of large dimensions.

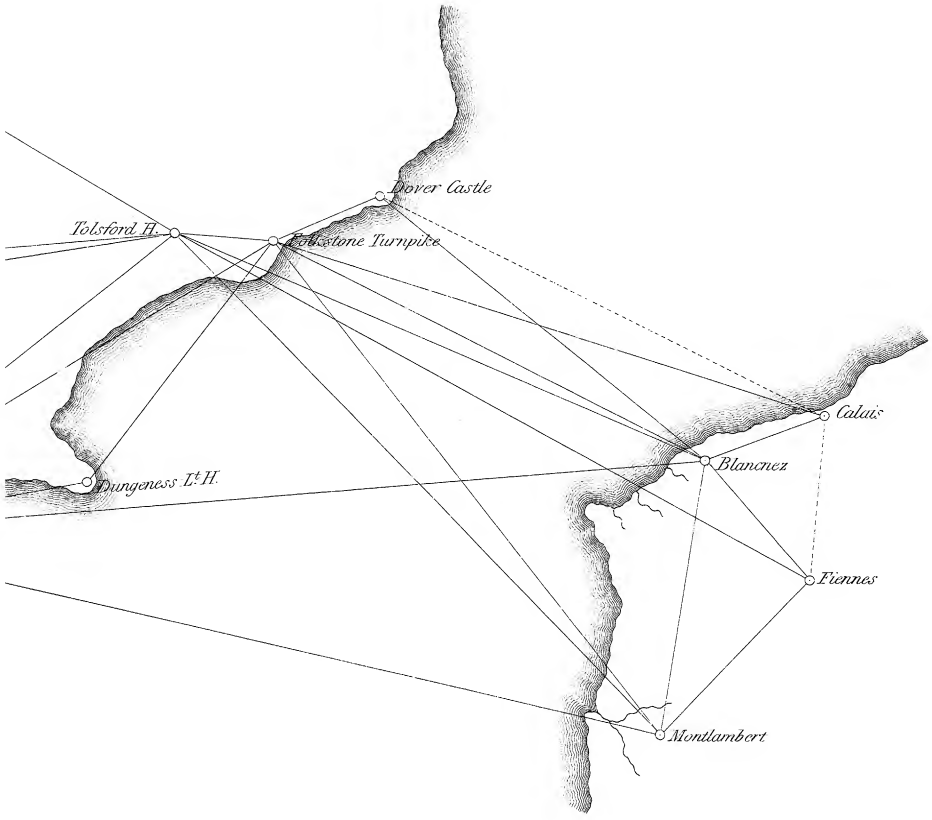
The errors which may arise from lateral refraction have often been suspected but never clearly ascertained. In the course of our work, however, we had such evidence of the fact as to leave no doubt of its existence. The angle between the same objects would differ under the most favourable circumstances about five seconds on different days, and perhaps a second and a half or two seconds may be considered as the error which may affect an angle from lateral refraction in an ordinary state of the atmosphere. During the observations at Stede Hill one fine day, the telescope being directed to the staff at Wrotham, a shower rapidly approached from the left, and the staff gradually receded from the cross wires until it was obscured by the intervening haze. At Leith Hill, after unfavourable weather, it cleared up in the evening, and though there was no wind, very extraordinary differences were perceived in the angles, for which it would have been difficult to assign any other cause than lateral refraction, varying considerably at short intervals.

At Montlambert we had very decided evidence of lateral refraction affecting the angle between Fairlight lamp and Tolsford lamp. These objects were taken on the evening of the 13th October, by M. Arago, Colonel Colby, and myself, under the most favourable circumstances. The observations were repeated on the morning of the 14th, and the mean of the five deduced angles differed from the mean of the seven angles of the preceding evening $2''.13$. In the table of the angles at Montlambert I have separated those of the evening of the 13th from those obtained on the morning of the 14th by a dotted line. So persuaded was I of the existence of this source of inaccuracy, that I seldom left any station until I found the difference between an angle observed at different times amount to about five seconds, which I considered to be the extreme limits of error.

There is a source of error in the great theodolite, and which may attach, though from different causes, to other instruments which are read off by means of microscopes; I allude to the variation in "the run", as it is termed, of the microscope. The head of the micrometer is divided into sixty parts, consequently each part should be equal to one second, and one revolution equal to a minute. In order to effect this, the object-glass of the microscope is placed by the observer at such a distance from the limb of the instrument as to form an image of the arc comprised between two neighbouring divisions, of such an extent as that the micrometer head shall make an even number of revolutions equal to the number of minutes, in passing over the space from division to division. This having been nearly attained, the tube containing the eye-glass and micrometer is moved until the divisions are seen distinctly, and the operation is repeated until the result is satisfactory. Now, in taking the instrument from station to station, the cone of the theodolite is lowered upon the axis to prevent injury, and the adjustments just described must be repeated at each station. But this is not the only inconvenience; for the microscopes will frequently alter their run from expansion, or any cause which may affect the distance between the limb and the object-glass. On the occasion of comparing certain standards of linear measure, I abandoned the usual form of the micrometer microscope, for an arrangement which, I conceive, possesses decided advantages over it; and which, in the case of circular instruments, appears to be liable to no other inconvenience than that of re-


Chingford S.
Hanger H. Tower
St. Paul's
Westminster Abbey
Royal Observatory
Severndroog Castle
Wrotham Hill
Stede Hill
Leith Hill
Frant Church
Tenterden Church
Growborough
Fairlight Down
Meridian of Greenwich.
Scale of Mil
0
10
20

TRIANGLES
for connecting the
MERIDIANS OF PARIS
and
GREENWICH.



Scale of Miles.

20 30 40

quiring the use of a table to reduce the measurements to arc. If a microscope furnished with cross wires fixed in the focus of the eye-glass be moved parallel to itself by a micrometer screw, it will measure the actual distance which it passes over, and no error can arise from a variation of the distance between the limb of the instrument and the object-glass of the microscope. It possesses also this further advantage, that the object-glass may be changed, and the power of the microscope varied at pleasure without affecting the scale. This construction, I cannot but feel, would be a considerable improvement if applied to astronomical circles, where very minute quantities are the objects of research; as any error arising from the want of strict perpendicularity of the plane of the circle to the axis of motion, or from any other cause which might vary the distance of the circle from the microscope, would be avoided.

I have stated that staffs were erected at Fairlight and at Folkstone near the lamps. These were occasionally taken at Blancnez and Montlambert, and a correction therefore became necessary to reduce such angles to what they would have been had the lamps been observed. To obtain the data for computing this correction, Mr. GARDNER made a plan (Plate X.) of the relative positions of the staff and lamp for each station.

A sketch of the triangles constituting the present work is given in Plate XI. The Tables require little explanation. The angles are given as deduced by means of five microscopes, and also by the two opposite microscopes. At Blancnez the letters indicating the names of the observers have not been prefixed, as the angles were individually determined by every one of the party. To the observed angles at each station is added the manner in which such angles have been derived, as could not be obtained by direct observation. Lastly, the readings are given of such objects as were selected for the purpose of identifying the stations: and here it is necessary to bear in mind that the degrees of the great theodolite are numbered from zero to 180°, and that then the numbering is recommenced.

Tables are also given detailing the observations of the Pole-star. From the observed time, the error of the chronometer, and the time of the star's southing, the horary angle is computed in mean time and in degrees; and by means of the horary angle, the polar distance, and the co-latitude, the azimuth is deduced, and the reading at the meridian is obtained.

TABLES *of Observed Angles, &c.*

At Hanger Hill.

Severndroog and Leith Hill.

Observers.	Five Microscopes.	Mean. Five.
G.	83° 26′ 24″.08	24″.32
	24.57	
G.	83 26 21.60	22.52
	23.45	
G.	83 26 23.85	22.55
	21.25	
G.	83 26 24.90	24.60
	24.30	
G.	83 26 23.90	23.70
	23.50	
K.	83 26 25.10	23.92
	22.75	
C.	20.95	21.32
	21.70	
Mean		23.28
Rejecting the last,		23.60

Westminster Abbey and Leith Hill.

Observers.	Five Microscopes.	Mean. Five.
G.	84° 59′ 59″.16	58″.45
	57.75	
G.	84 59 56.95	57.30
	57.65	
K.	84 59 59.90	58.32
	56.75	
G.	84 59 59.87	58.91
	57.95	
G.	84 59 58.95	58.95
K.	84 59 54.80	55.67
	56.55	
K.	54.40	55.87
	57.35	
C.	54.83	53.49
	52.15	
G.	54.37	54.37
Mean		56.81

Leith Hill and St. Paul's.

Observers.	Five Microscopes.	Mean. Five.
G.	93° 13′ 2″.50	3″.10
	3.70	

Observations for identifying the Station.

	Readings. °	′	″
Harrow Spire	178	48	35.31
Small white Spire, distant about two miles, supposed Kingsbury	52	12	37.50
Hendon Church Vane-staff	57	5	49.12
Pancras New Church	111	56	11.75
Marylebonne Church	114	20	51.50
Bayswater Chapel	116	8	11.25
St. Paul's	118	20	56.90
Westminster Abbey (N.W. pinnacle)	126	34	7.21
Leith Hill Station	31	34	6.12

	Readings. °	′	″
Dome of Chelsea College	136	13	51.50
The Ball of the Horizontal Mill at Battersea	144	35	14.50
Battersea Spire	145	17	20.50
The Centre of Knockholt Beeches	154	17	12.00
Cupola of a new Church, five miles	158	33	59.25
Croydon Church Tower	165	20	51.62
Kew Pagoda	21	46	56.00
Vane of Ealing Cupola	36	31	56.25
Windsor Castle Flag-staff	102	33	39.75

At Severndroog Tower.

Wrotham, and Leith Hill.					Chingford and Wrotham.				
Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.	Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
	° ′ ″	″	″	″		° ′ ″	″	″	″
K.	86 25 58.70		58.12		K.	149 26 18.75	18.25	17.88	17.69
C.K.&G.	57.10	57.20	57.00	57.91		17.75		17.50	
	57.30		58.82		C.K.&G.	18.10	17.10	18.63	16.37
	58.15	57.77	58.87	59.12		16.10		14.12	
	57.40		59.38			15.60	17.05	14.13	16.37
	56.45		63.25			18.50		18.62	
G.	57.96	55.75	58.92	57.46		21.20	19.90	15.38	20.06
	53.55		56.00			18.60		24.75	
K.	54.10	56.20	57.44	58.72	G.	16.37		15.00	
	58.30		60.00		K.	18.10	16.92	14.87	15.06
C.	57.00	56.75	58.88	57.94		15.75		15.25	
	56.50		57.00		K.C.&G.	149 26 13.25	12.60	12.63	11.81
G.	57.65	59.85	59.62	60.93		11.95		11.00	
	62.05		62.25			13.50	12.87	13.50	13.62
K.C.&G.	86 25 56·05	56.37	52.50	54.25		12.25		13.75	
	56.70		56.00			149 26 14.45	16.45	14.12	15.00
	54.90	52.77	54.12	51.50		18.45		15.88	
	50.65		48.88						
	53.65	54.37	52.87	53.06	C. & K.	149 26		11.79	10.96
	55.10		53.25					10.13	
								10.00	11.00
K.C.&G.	86 25		57.00	58.15				12.00	
			59.31		*	149 26		17.00	
	86 25		53.75	56.87				20.00	
			60.00			149 26		12.00	11.81
			57.75	58.56				11.62	
			59.38					14.37	13.56
	86 25		57.12	57.75				12.75	
			58.38			149 26		15.75	14.81
			59.50	59.25				13.88	
			59.00					12.75	13.37
	86 25		60.00	60.18				14.00	
			60.37			149 26		17.13	14.63
			59.50	57.75				12.13	
			56.00		G.	149 26 15.15	15.10	13.38	14.25
	57.50	56.65	57.00	57.87		15.05		15.13	
	55.80		58.75		G.	16.10	15.80	16.00	15.62
	54.95	56.92	57.50	57.87		15.50		15.25	
	58.90		58.25		G.	15.45	15.17	10.37	12.62
	86 25 61.40	61.02	59.88	60.13		14.90		14.87	
	60.65		60.38		G.	149 26		13.75	14.44
	57.35	57.87	56.75	58.06				15.13	
	58.40		59.38		K. & G.	12.85	12.17	16.50	13.25
						11.50		10.00	
General mean.....		56.88	.....	57.67	General mean.....		15.78	.....	14.31
Mean below the line..		58.11	.....	58.40	Mean below the line..		14.56	.....	13.36

* A bad dot.

Severndroog Tower (Continued).

Hanger Hill and Chingford.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
K.	62° 57′ 24″.05	23″.67	25″.25	24″.44
	23.30		23.62	
K.C.&G.	62 57		24.50	25.12
			25.75	
			22.50	21.94
			21.38	
			22.75	23.00
			23.25	
	62 57		21.87	22.87
			23.87	
			24.50	23.81
			23.12	
	62 57		26.50	26.00
			25.50	
			25.27	26.23
			27.19	
G.	62 57		23.38	
G.			24.63	24.81
			25.00	
	Mean	....	23.67	24.25

Leith Hill and Chingford.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
K.	124° 7′ 42″.55	″	44″.00	″
C.	44.80	45.70	44.37	45.71
	46.60		47.06	
C.	46.25	45.17	47.00	44.50
	44.10		42.00	
C.	42.35		41.37	
G.	45.67		46.08	
K.	47.80	46.87	47.69	46.22
	45.95		44.75	
K.C.&G.	124 7 50.70	51.02	54.87	53.93
	51.35		53.00	
K.C.&G.	51.60	54.35	42.38	49.87
	57.10		57.37	
	Mean.. 47.43	48.62	47.07	48.05

Chingford, and Westminster Abbey.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
K.	61° 33′ 50″.25	″	50″.13	″
	52.65	51.45	52.87	51.50
C.	48.55	49.72	48.37	49.62
	50.90		50.88	
K.	51.95	50.75	53.13	51.19
	49.55		49.25	
G.	52.00	51.90	52.50	52.50
	51.80		52.50	
	Mean	50.95		51.20

Chingford, and Greenwich Observatory.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
C.	60° 55′ 19″.10	″	19″.37	″
	20.75	19.92	22.50	20.93
	19.30			
	24.05	21.67		
	20.05		21.00	
K.C.&G.	20.50	21.87	22.50	
	23.25		25.75	24.12
	20.60	21.47	23.50	
	22.35		23.12	23.31
	Mean	21.23		22.79

Chingford and St. Paul's.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	51° 43′ 17″.20	″	16″.87	″
	19.35	18.27	19.38	18.12
K.	18.15	18.50	18.88	
	18.85		19.50	19.19
C.	15.65	18.42	16.00	
	21.20		21.75	18.87
K.	20.55	20.25	21.63	
	19.95		21.62	21.62
G.	20.25	19.82	21.12	
	19.40		21.00	21.06
	Mean	19.05		19.77

Angles derived at Severndroog Castle.

	°	′	″
Chingford and Wrotham	149	26	13.36
Wrotham and Leith Hill	86	25	58.40
Hanger Hill and Chingford	62	57	24.25
Sum....	298	49	36.01
	360	0	0.00
Hanger Hill and Leith Hill	61	10	23.99
Hanger Hill and Chingford	62	57	24.25
Chingford and Leith Hill	124	7	48.62
	61	10	24.37
	61	10	23.99
Mean..Hanger Hill and Leith Hill	61	10	24.18

	°	′	″
Chingford and Leith Hill	124	7	48.62
Chingford and Westminster Abbey	61	33	50.95
Leith Hill and Westminster Abbey	62	33	57.67
Chingford and Leith Hill	124	7	48.62
Chingford and St. Paul's	51	43	19.05
Leith Hill and St. Paul's...	72	24	29.57

Observations for identifying the Station.

	Readings. °	′	″
Eltham Spire	145	27	51.25
Cupola on Bromley Tower	152	4	39.25
Beckenham Spire	169	16	1.25
Leith Tower (Centre)	169	39	15.00
Croydon Church (Centre).....	174	29	33.75
Norwood Mill	8	27	53.12
Lewisham Church Vane	23	32	37.37
Leigh Spire (Centre).....	31	37	34.00
Peckham Chapel Spire	42	39	4.87
Deptford Spire	50	21	9.56
New Chapel east side of Blackheath Cross	47	37	49.50
Centre of Octagon Room, Royal Observatory	52	53	30.62
Vane Cupola of Greenwich Observatory	52	58	1.12
Greenwich Spire	57	7	5.00
Newington Butts Church Cupola	56	26	27.50
St. George's Church Spire (Copper Ball).....	56	34	19.12

	Readings. °	′	″
West Cupola of Greenwich Hospital	58	15	23.50
East Cupola of ditto	58	45	37.12
Bermondsey Church	58	51	44.00
St. Saviour's Church (Centre) ..	59	30	25.87
Spire North end of London Bridge	61	38	45.87
St. Paul's	62	5	30.87
St. Dunstan's East.....	62	23	20.00
The Monument	62	6	22.50
The Tower Flag-staff	62	34	18.12
Flamsteed's Observatory, N.E. Cupola of the Tower.....	62	41	59.75
St. Matthew's Bethnal Green, a Tower with a Cupola.....	74	49	57.12
Limehouse Church.....	75	7	4.87
Charlton Church Flag-staff	81	14	6.37
Direction of Roy's Station.....	98	15	0.00
Woolwich Church Flag-staff....	125	27	18.50

At Chingford.

Wrotham and Severndroog.					Severndroog and St. Paul's.				
Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.	Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
	° ′ ″	″	″	″		° ′ ″	″	″	″
K.	16 34 60.25		62.00		K.	39 0 37.05		35.13	
G.	58.90		60.88			36.20	36.62	35.13	35.13
G.	16 34 60.90		62.12		C. & G.	36.33		34.94	
	60·50	60.70	61.87	61.99		34.75	35.54	34.00	34.47
	16 34 61.20		59.50		K.	38.00		23.13	
	63.55	62.42	62.00	60.75		37.60	37.80	37.00	30.06
	16 34 61.80		63.87		G.	39 0 34.70		34.00	
	60.60	61.20	65.75	64.81		35.10	34.90	34.62	34.31
	16 34 60.10		60.38		G.	34.50		33.25	
	61.85	60.97	61.25	60.81		36.90	35.70	36.25	34.75
	16 34 62.70		64.87						
	62.40	62.55	62.37	63.62		Mean	36.11	.....	33.74
	Mean	61.57	.....	62.40					

With the Ordnance Theodolite, July 1823.

Wrotham and Severndroog.					Severndroog, and Greenwich Observatory.				
Observers.	Three Microscopes.	Mean. Three.			Observers.	Three Microscopes.	Mean. Three.		
	° ′ ″	″				° ′ ″	″		
K.	16 34 62.75				K.	12 51 23.92			
	62.33	62.54				27.34	25.63		
C.	65.00					24.50			
	61.16	63.08				24.66	24.58		
K.	62.00					26.00			
	61.75	61.87				23.83	24.91		
K.	62.50					26.17			
	62.75	62.63				24.58	25.37		
K.	62.91					12 51 27.59			
	62.67	62.79				23.67	25.63		
K.	62.58								
	61.67	62.13							
K.	16 34 55.83								
	60.83	58.33							
	Mean	61.91				Mean	25.22		

Chingford (Continued).

With the Ordnance Theodolite, July 1323.

Severndroog and St. Paul's.				
Observers.	Three Microscopes.	Mean. Three.		
K.	39° 0′ 36″.92	36.21		
	35.50			

Westminster Abbey and Severndroog.				
Observers.	Three Microscopes.			
	42° 52′ 09″.42			
	09.50			
	09.42			
	42 52 12.12			
	42 52 10.35			
	Mean 10.16			

Wrotham, and Centre of Observatory.				
Observers.	Three Microscopes.	Mean. Three.		
K.	29° 26′ 25″.96	27.52		
	29.09			
	27.33	27.37		
	27.41			
	28.91	27.70		
	26.50			
	28.67	28.21		
	27.75			
	28.75	26.82		
	24.92			
	29 26 23.42	23.96		
	24.50			
	Mean	26.93		

Observations for identifying the Station.

	Readings.				Readings.
St. Paul's	32° 49′ 39″.37		Hadleigh Church Beacon	108° 33′ 59″.37
Holloway Chapel	43 36 31.87		Barnet Church Vane	104 25 22.50
Chingford Church Tower	41 44 15.75			

At Wrotham.

Crowborough, and Leith Hill.					Fairlight and Severndroog.				
Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.	Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
K. (P.M.)	53° 57′ 50″.00	49.97	50.00	50.62	K.	162° 35′ 46″.45	48.40	45.87	48.31
	49.95		51.25			50.35		50.75	
K. (A.M.)	49.70	49.82	50.25	50.31	K.	47.40	46.52	46.75	46.56
	49.95		50.37			45.65		46.38	
G. (P.M.)	53 57 52.45	52.92	51.75	51.56	K.	48.75	47.07	48.75	47.81
	53.40		51.37			45.40		46.88	
C. (P.M.)	53.70	52.47	51.75	51.25	G.	47.40	45.72	46.63	45.19
	51.25		50.75			44.05		43.75	
C. (P.M.)	51.25	50.25	50.75	49.06	G.	48.50	47.57	49.25	48.18
	49.25		47.37			46.65		47.12	
G. (P.M.)	51.05	51.42	49.75	50.12	G.	47.90	48.02	48.75	48.62
	51.80		50.50			48.15		48.50	
G.	51.45		50.88		G.	162 35 49.75	48.25	48.00	46.43
K.	53 57 51.30	51.05	51.87	51.50		46.75		44.87	
	50.80		51.13						
G.	52.70		52.75			Mean	47.36	.....	47.30
	Mean	51.13	.....	50.63					

Wrotham (Continued).

Severndroog and Chingford.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	13° 58′ 44.55″	45.87	42.38	44.87
	47.20		47.37	
G.	13 58 41.00	43.15	38.62	39.25
	45.30		39.88	
C.	42.12	43.68	38.75	40.56
	45.25		42.38	
G.	45.60	45.60	43.38	42.37
	45.60		41.37	
G.	42.50	42.67	38.87	39.31
	42.85		39.75	
C.	42.65	42.57	39.63	39.63
	42.50		39.63	
G.	13 58 46.40	45.85	45.75	45.06
	45.30		44.37	
C.	44.85	44.62	44.50	44.25
	44.40		44.00	
G.	44.50	43.77	44.25	45.06
	43.05		45.88	
	Mean	44.20		42.26

Leith Hill and Severndroog.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
K. (P.M.)	65° 26′ 47.65″	48.22	46.62	47.12
	48.80		47.63	
K. (P.M.)	47.80	47.15	46.00	45.31
	46.50		44.63	
C. (P.M.)	48.65	47.62	48.12	46.75
	46.60		45.38	
K. (A.M.)	49.25	47.82	47.87	46.87
	46.40		45.88	
G. (P.M.)	65 26 48.55	46.60	47.25	46.37
	44.65		45.50	
C. (P.M.)	44.80	46.95	47.13	47.81
	49.10		48.50	
G. (P.M.)	47.10	48.30	47.75	47.93
	49.50		48.12	
G. (P.M.)	52.00	48.79	51.00	48.93
	45.58		46.87	
K.	65 26 45.40		47.13	
	Mean	47.68	.....	47.14

Crowborough and Chingford.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	133° 23′ 26.65″	25.20	27.00	24.87
	23.75		22.75	
	Mean	25.20	.....	24.87

Stede Hill and Crowborough.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
K. (P.M.)	93° 16′ 51.65″	51.47	50.88	51.19
	51.30		51.50	
	51.95		51.82	
K. (P.M.)	49.45	49.57	50.87	49.81
	49.70		48.75	
K. (A.M.)	47.65	47.60	47.06	47.47
	47.55		47.88	
K. (A.M.)	47.55	47.82	47.88	47.81
	48.10		47.75	
C. (A.M.)	50.30	49.17	49.37	48.75
	48.05		48.13	
G. (P.M.)	93 16 48.30	49.40	49.50	50.69
	50.50		51.88	
C. (P.M.)	50.90	50.05	51.25	51.12
	49.20		51.00	
G. (P.M.)	52.85	50.72	53.75	52.50
	48.60		51.25	
G. (P.M.)	93 16 51.65	51.82	51.88	52.75
	52.00		53.63	
C. (P.M.)	50.55		51.63	
	motion		55.05	
			56.00	motion
G. (P.M.)	51.90	50.70	52.00	51.81
	49.50		51.63	
G. (P.M.)	51.25	52.77	52.63	53.31
	54.30		54.00	
K.	93 16 53.00	51.09	49.75	49.53
	49.18		49.31	
K.	44.30	45.05	44.63	44.12
	45.80		43.62	
	46.35	46.27	44.50	45.00
	46.20		45.50	
	Mean	49.54	.....	49.70

Wrotham (Continued).

Stede Hill and Fairlight.					Fairlight and Crowborough.				
Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.	Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
K. (P.M.)	50° 5′ 42.35	40.45	42.13	40.06	K. (P.M.)	43° 11′ 9.60	9.40	10.75	10.62
	38.55		38.00			9.20		10.50	
K. (P.M.)	39.85	40.17	40.12	39.18	K. (A.M.)	9.98	9.89	10.62	10.62
	40.50		38.25			9.80		10.63	
K. (A.M.)	37.67	37.71	36.44	36.84	K. (A.M.)	9.80	9.42	10.63	10.63
	37.75		37.25			9.05		10.63	
K. (A.M.)	37.75	38.40	37.25	37.18	C. (A.M.)	10.35	9.72	10.75	10.44
	39.05		37.12			9.10		10.13	
C. (A.M.)	39.95	39.45	38.62	38.31	G. (P.M.)	43 11 6.40	6.20	7.63	7.25
	38.95		38.00			6.00		6.88	
G. (P.M.)	50 5 41.90	43.20	41.87	43.43	C. (P.M.)	10.00	8.15	10.37	9.12
	44.50		45.00			6.30		7.87	
C. (P.M.)	40.90	41.90	40.88	42.00	G. (P.M.)	9.75	8.30	11.25	10.56
	42.90		43.13			6.85		9.88	
G. (P.M.)	43.10	42.42	42.50	41.93	G. (P.M.)	43 11 10.55	9.07	9.13	8.06
	41.75		41.37			7.60		7.00	
C. (P.M.)	50 5 40.15	40.20	41.75	42.31	C. (P.M.)	supposed 11.85	13.12	10.63	11.25
	40.25		42.88			motion. 14.40		12.87	
G. (P.M.)	41.10	42.75	42.75	44.69	G. (P.M.)	11.35	9.57	8.88	8.06
	44.40		46.63			7.80		7.25	
C. (P.M.)	supposed 38.70	39.67	41.00	42.06					
	motion. 40.65		43.13			Mean	9.28	.....	9.66
G. (P.M.)	40.55	41.12	43.12	43.75					
	41.70		44.38			Rejects 13.12	8.86	.....	9.48
	Mean	40.62	.....	40.98					

Observations for identifying the Station.

	Readings.		Readings.	
A Spire	23° 1′ 47.00″	A Tower about 2 miles distant ..	94° 54′ 46.62″	
A Tower near	23 51 18.25	Wadhurst Spire	88 12 1.00	

The Station is in the north-west corner of a field upon Wrotham Hill, called "The Plains."

At Leith Hill.

Hanger Hill and St. Paul's.					St. Paul's and Severndroog.				
Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.	Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	19° 21′ 59.65	60.67	61.25	62.12	G.	16° 1′ 17.00	15.85	17.62	15.87
	61.70		63.00			14.70		14.13	
K.	60.85	60.07	61.25	61.12	K.	15.80	15.42	15.50	14.81
	59.30		61.00			15.05		14.12	
G.	19 21 58.90	57.57	58.18	56.21	G.	16 1 14.60	16.12	15.13	17.25
	56.25		54.25			17.65		19.38	
K.	60.70	59.70	59.56	59.15	K.	13.32	15.61	14.50	16.75
	58.70		58.75			17.90		19.00	
	Mean	59.50	.....	59.65		Mean	15.75	.....	16.17

Leith Hill (Continued).

Hanger Hill and Severndroog.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	35° 23′ 14.80″	13.57″	16.50″	15.68″
	12.35		14.87	
C.	12.75	13.80	15.00	15.19
	14.85		15.38	
K.	11.75		13.75	
G.	35 23 12.60	12.25	12.88	12.94
	11.90		13.00	
K.	13.88	13.41	14.69	13.72
	12.95		12.75	
G.	10.97	10.78	10.75	11.31
	10.60		11.87	
K.	14.40		16.62	
G.	35 23 16.65	16.52	18.87	18.00
	16.40		17.13	
K.	16.65	15.50	16.75	15.93
	14.35		15.12	
G.	35 23 13.50	13.70	13.31	13.47
	13.90		13.63	
K.	14.02	15.31	14.06	15.90
	16.60		17.75	
	Mean	13.87	.....	14.68

Severndroog and Wrotham.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	28° 7′ 17.57″	18.31″	18.56″	18.21″
	19.05		17.87	
K.	28 7 17.60	17.61	18.75	18.19
	17.63		17.63	
C.	17.35	16.87	17.50	17.25
	16.40		17.00	
G.	16.35	15.70	17.38	16.78
	15.05		16.19	
K.	28 7 17.75	15.57	16.25	13.94
	13.40		11.63	
K.	18.60	17.62	16.63	16.00
	16.65		15.37	
G.	28 7 15.50	15.47	14.00	14.18
	15.45		14.37	
K.	13.75	14.02	14.13	13.75
	14.30		13.38	
G.	28 7 18.15	16.57	17.25	16.06
	15.00		14.87	
	Mean	16.42	.....	16.04

Wrotham and Crowborough.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	38° 56′ 57.45″	56.88″	59.87″	58.24″
	56.32		56.62	
G.	56.00	54.65	55.38	56.38
	53.30		57.38	
G.	54.50	56.90	57.00	58.15
	59.30		59.31	
G.	57.60		57.00	
G.	56.61	55.65	56.36	56.30
	54.70		56.25	
K.	55.65	55.60	59.00	57.31
	55.55		55.62	
G.	55.85	54.87	55.00	55.87
	53.90		56.75	
K.	38 56 56.75	56.90	56.75	57.06
	57.05		57.37	
C.	56.85	56.85	56.13	57.19
	56.85		58.25	
G.	56.90	56.22	56.87	55.81
	55.55		54.75	
G.	38 56 55.00	55.00	55.25	54.56
	55.00		53.88	
	Mean	55.95	.....	56.69

Hanger Hill and Westminster.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	17° 42′ 36.70″	37.20″	38.87″	38.81″
	37.70		38.75	
G.	17 42 39.39	34.66	39.88	35.59
	29.93		31.31	
G.	17 42 33.10	34.22	35.25	35.43
	35.35		35.62	
K.	35.67	34.78	35.99	35.80
	33.90		35.62	
G.	37.85	39.30	39.75	40.19
	40.75		40.63	
K.	36.45	37.10	37.50	38.31
	37.75		39.12	
G.	17 42 37.65	36.82	35.18	35.15
	36.00		35.13	
K.	37.97	38.86	37.31	37.78
	39.75		38.25	
	Mean	36.62	.....	37.13

Leith Hill (Continued).

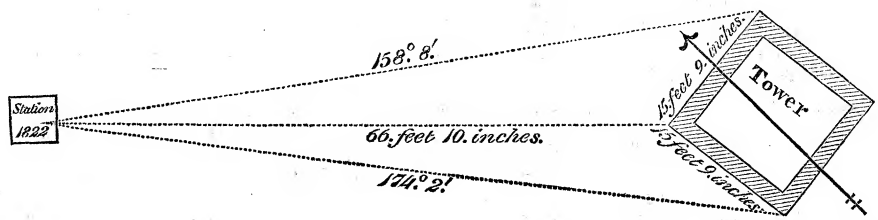
Westminster Abbey and Severndroog.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	17° 40′ 38.″10	36.″37	37.″63	36.″87
	34.65		36.12	
G.	31.58	36.12	30.87	35.71
	40.67		40.56	
G.	17 40 39.20	37.42	39.12	37.81
	35.65		36.50	
K.	39.20	37.90	39.25	37.62
	36.60		36.00	
G.	17 40 35.85	36.87	38.13	38.31
	37.90		38.50	
K.	36.05	36.45	36.75	38.12
	36.85		39.50	
	Mean	36.85	.....	37.41

Observations for identifying the Station.

	Readings. °	′	″
Vane of a Church about 2 miles beyond Box Hill on high ground	59	6	50.12
Cupola Vane of Ewherst Church	90	17	1.12
Abinger Church Spire	168	20	57.50
Severndroog Castle Flag-staff..	71	15	51.25
Left Edge of Leith Tower	158	8	0.00
Right Edge of Leith Tower....	174	1	48.50
Apex of a White Tower Church about 2 miles, (possibly Okeley)	175	13	59.00

The North-west Angle of Leith Tower is distant from the Station 66 feet 10 inches.



At Stede Hill.

Fairlight and Crowborough.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	53° 13′ 24.″15	24.″20	25.″15	25.″76
	24.25		26.38	
G.	53 13 23.35	24.33	23.62	24.44
	25.30		25.25	
G.	53 13	....	22.38	
	without clamping			
K.	53 13 25.65			
	slight clamping			
G.	.....25.00	24.47		
	23.95			
	Mean	24.33	.....	25.10

Tolsford and Crowborough.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	118° 37′ 37.″00	36.″96	37.″02	38.″23
	36.92		39.44	
G.	118 37 35.55	36.47	37.12	39.06
	37.39		41.00	
G.	118 37	....	36.50	
	without clamping			
K.	..... 35.80			
	slight clamping			
G.	..... 34.85	35.60		
	36.35			
	Mean	36.34	38.22	38.64

Stede Hill (Continued).

Fairlight and Wrotham.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	97° 58′ 15″.72	16″.37	15″.56	16″.56
	17.02		17.56	
G.	97 58 15.60	16.70	13.62	14.56
	17.80		15.50	
G.	97 58 14.38			
with	out clamping. H	eavy sh	ower appro	aching
	Wrotham from	Crowb	orough.	
K.	21.20			
	slight clamping			
G.	16.80	18.45		
	20.10			
	without clamping			
K.	18.20	17.02		
	15.85			
	Mean	17.13		15.56

Tolsford and Wrotham.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	163° 22′ 28″.57	29″.12	27″.43	29″.02
	29.67		30.62	
G.	163 22 27.80	28.84	27.12	29.18
	29.89		31.25	
G.	163 22	....	28.50	
G.	29.85			
	slight clamping			
G.	..... 26.65	29.57		
	32.50			
	without clamping			
K.	..... 29.35	28.65		
	27.95			
	Mean	29.52	.....	29.10

Tolsford and Fairlight.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	65° 24′ 12″.85	12″.76	11″.87	12″.46
	12.67		13.06	
G.	65 24 12.20	12.14	13.50	14.81
	12.09		16.12	
G.	65 24	....	14.12	
K.	65 24 10.15			
	slight clamping			
G.	9.85	11.12		
	12.40			
	without clamping			
K.	11.15	11.62		
	12.10			
	slight clamping			
G.	65 24 11.15	10.72		
	10.30			
C.	.....	....	11.32	
	Mean	11.67	13.33	13.63

Crowborough and Wrotham.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	44° 44′ 51″.57	52″.16	50″.41	50″.79
	52.75		51.18	
G.	44 44 52.25	52.36	50.00	50.12
	52.50		50.25	
G.	44 44	....	52.00	
	slight clamping			
G.	51.80	53.97		
	56.15			
	Mean	52.83	.....	50.45

Observations for identifying the Station.

	Readings.
Bottom of the Spindle of the Vane of Charing Church.	92° 10′ 5″.00
Bottom of the Spindle of the Vane of Lenham Church.	65 2 32.12
Bottom of the Spindle of the Vane of Harrietsham Church.	128 24 39.37
Bottom of the Spindle of the Vane of Hollingbourn Church.	51 15 6.12

At Crowborough.

Tolsford and Fairlight.

Observers.	Five Microscopes.	Mean. Five.
G.	36° 5′ 24″53	25.26
	26.00	
K.	28 48	27.04
	25.60	
G.	36 5 20.75	22.07
	23.40	
G.	36 5 22.83	21.66
	20.50	
	Mean	24.01

Wrotham and Tolsford.

Observers.	Five Microscopes.	Mean. Five.
G.	67° 36′ 60″.42	59.38
	58.35	
K.	57.77	58.76
	59.75	
G.	60.67	60.43
	60.20	
G.	67 36 62.02	63.26
	64.50	
	Mean	60.46

Frant Church and Tolsford.

Observers.	Five Microscopes.	Mean. Five.
G.	25° 25′ 57″.75	
G.	59.57	57.91
	56.25	
K.	55.52	56.83
	58.15	
G.	25 25 59.47	58.57
	57.67	
G.	25 25 63.02	
	Mean.. 58.42	57.77

Leith Hill and Wrotham.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
K.	87° 5′ 14″.55	15.10		
	15.65			
K.	15 97	14.98	18.19	17.34
	14.00		16.50	
G.	14.83	15.44		
	16.05			
K.	15.40	14.85		
	14.30			
C.	87 5 14.48	15.24		
	16.00			
G.	87 5 15.05	14.35		
	13.65			
G.	87 5 13.90	13.10		
	12.30			
G.	87 5	....	14.38	
	87 5	....	12.87	
G.	16.90	15.75	17.25	17.25
	14.60		17.25	
G.	87 5 17.90	16.46	17.63	16.63
	15.20		15.63	
	87 5 16.15	14.87	13.25	12.62
	13.60		12.00	
	Mean	15.01	.....	15.96

Frant Church and Fairlight.

Observers.	Five Microscopes.	Mean. Five.
K.	61° 31′ 22″.75	
K.	19.85	20.75
	21.65	
G.	24.10	23.17
	22.25	
K.	24.00	23.87
	23.75	
C.	61 31 22.15	23.45
	24.75	
G.	61 31 20.22	20.64
	21.07	
G.	61 31 25.85	
	Mean	22.38

Crowborough (Continued).

Leith Hill and Stede Hill.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
K.	129° 4′ 34.40″	″	″	″
K.	36.85	35.92	38.62	38.43
	35.00		38.25	
G.	35.91	36.13		
	36.35			
K.	35.75	35.65		
	35.55			
C.	129 4 36.78	37.94		
	39.10			
G.	129 4 33.30	34.44		
	35.58			
G.	129 4 32.70	34.06		
	35.42			
G.	129 4 37.25	35.30	33.38	32.69
	33.35		32.00	
	Mean	35.63	.....	35.56

Wrotham and Fairlight.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
K.	103° 42′ 25.60″	″	″	″
K.	23.63	23.99	23.06	23.25
	24.35		23.44	
G.	24.95	24.65		
	24.35			
K.	26.25	25.80		
	25.35			
C.	103 42 24.90	26.52		
	28.15			
G.	103 42 21.42	22.51		
	23.60			
G.	103 42 24.85	24.92		
	25.00			
G.	103 42 23.80	24.05	23.00	23.31
	24.30		23.62	
	Mean	24.63	.....	23.28

Wrotham, and Stede Hill.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
K.	41° 58′ 19.85″	″	″	″
K.	20.88	20.94	20.43	21.09
	21.00		21.75	
G.	21.08	20.69		
	20.30			
K.	20.35	20.80		
	21.25			
C.	41 58 22.30	22.70		
	23.10			
G.	41 58 18.25	20.09		
	21.93			
G.	41 58 18.80	20.96		
	23.12			
	41 58 21.10	20.42	20.13	20.06
	19.75		20.00	
	Mean	20.94	.....	20.57

Stede Hill and Fairlight.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
K.	61° 44′ 5.75″	″	″	″
K.	2.75	3.05	2.63	2.16
	3.35		1.69	
G.	3.87	3.96		
	4.05			
K.	5.90	5.00		
	4.10			
C.	61 44 2.60	3.82		
	5.05			
G.	61 44 3.17	2.42		
	1.67			
G.	61 44 6.05	3.96		
	1.88			
G.	61 44 2.70	3.62	2.87	3.24
	4.55		3.62	
	Mean	3.69	.....	2.70

Crowborough (Continued).

Frant Church and Stede Hill.					Stede Hill and Tolsford.				
Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.	Observers.	Five Microscopes.	Mean. Five.		
	° ′ ″	″	″	″		° ′ ″	″		
K.	0 12 43.00				G.	25 38 39.00			
K.	42.90	42.30	41.75	41.37	G.	39.57	38.81		
	41.70		41.00			38.05			
G.	41.25				K.	37.42	37.96		
G.	39.77	40.28				38.50			
	41.80				G.	25 38 42.42	40.34		
K.	41.90	41.12				38.27			
	40.35				G.	25 38 43.22	42.30		
C.	0 12 40.45	40.37				41.38			
	40.30								
	Mean.. 41.34	41.02				Mean	39.85		

Observations for identifying the Station.

	Readings.				Readings.	
	°	′	″		° ′ ″	
Hartfield Spire	70	39	3.00	Crowborough Chapel Spire	11 31 19.00	
Wadhurst Spire	7	4	48.75	Rotherfield Spire	23 52 44.25	

Observations repeated.

	Readings.				Readings.	
	°	′	″		° ′ ″	
Hartfield Spire	4	38	5.00	Crowborough Chapel Spire	125 20 25.50	
Wadhurst Spire	120	53	48.00	Rotherfield Spire	137 41 46.50	

At Tolsford.

Blancnez and Fairlight.					Fiennes, and Montlambert Station.				
Observers.	Five Microscopes.	Mean. Five.			Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
	° ′ ″	″				° ′ ″	″	″	″
G.	118 34 46.95	47.80			K.C.&G.	17 30 15.40	15.05	17.46	16.93
	48.65					14.70		16.41	
G.	118 34 48.55				K.	15.80	16.46	16.38	17.10
G.	118 34 51.72				K.C.&G.	17.13		17.83	
	Mean.. 48.97					Mean	15.75	.....	17.01

Tolsford (Continued).

Folkstone and Fairlight.

Observers.	Five Microscopes.	Mean. Five.
G.	136° 51′ 43″.40	44″.72
	46.05	
K.	45.20	46.01
	46.83	
G.	136 51 46.85	46.40
	45.95	
K.	46.45	45.99
	45.53	
G.	136 51 48.85	48.00
	47.15	
K.	50.45	48.55
	46.65	
	Mean	46.61

Fairlight, and Stede Hill.

Observers.	Five Microscopes.	Mean. Five.
G.	69° 7′ 60″.65	60″.40
	60.15	
K.	61.75	60.25
	58.75	
G.	69 7 57.50	59.05
	60.60	
K.	59.33	59.51
	59.70	
G.	69 7 54.50	54.72
	54.95	
K.	56.10	58.22
	60.35	
	Mean	58.69

Folkstone Church and Folkstone Station.

Observers.	Five Microscopes.	Mean. Five.
G.	14° 49′ 43″.70	43″.32
	42.95	
	Mean	43.32

Fiennes and Fairlight.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
K.	113° 18′ 17″.08	16″.90	19″.82	19″.34
	16.72		18.87	
K.C.&G.	17.50	18.01	20.34	21.25
	18.53		22.17	
	Mean	17.45	.....	20.29

Fairlight and Crowborough.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	33° 24′ 10″.56	8″.48		
	6.40			
G.	6.40	3.00		
	59.60			
K.C.&G.	5.12		2.28	
G.	33 24 10.00	9.19	9.62	8.96
	8.38		8.31	
	Mean .. 6.64	6.89	6.74	

Crowborough, and Stede Hill.

Observers.	Five Microscopes.	Mean. Five.
G.	35° 43′ 48″.00	51″.72
G.	35 43 48.10	
	55.35	
	Mean.. 50.48	

Folkstone and Nôtre Dame.

Observers.	Five Microscopes.
G.	10° 44′ 15″.90
G.	10 44 16.20
K.	17.20
	Mean.. 16.43

Tolsford (Continued).

Folkstone and Blancnez.

Observers.	Five Microscopes.	Mean. Five.
G.	18 16 56.45	56.92
	57.40	
G.	18 16 57.13	
	Mean .. 56.99	

Nôtre Dame and Fiennes.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
K.	12 49 12.15	12.68	12.50	13.84
	13.22		15.18	
K.C.&G.	15.18	15.26	17.25	16.75
	15.35		16.25	
	Mean	13.97	.....	15.29

Nôtre Dame, and Montlambert Staff.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
K.C.&G.	30 19 29.88	30.51	33.63	33.85
	31.15		34.08	
	Mean	30.51		33.85

Fairlight, and Montlambert Staff.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
C.K.&G.	95 48 1.32	2.06	2.41	3.18
	2.80		3.96	
	2.80	2.76	3.96	4.15
	2.73		4.34	
	Mean	2.41	.....	3.66

Nôtre Dame and Fairlight.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	126 7 27.50			
G.	126 7 29.75			
K.	30.30		35.00	
K.C.&G.	32.68	33.28	37.59	38.00
	33.88		38.42	
	Mean 30.82	....	37.00	

Stede Hill and Folkstone.

Observers.	Five Microscopes.	Mean. Five.
G.	154 0 15.95	14.87
	13.80	
K.	13.92	14.54
	15.16	
K.	13.05	13.73
	14.42	
G.	154 0 15.65	14.55
	13.45	
K.	13.70	
K.	14.22	14.49
	14.77	
G.	154 0 16.65	17.27
	17.90	
K.	13.45	13.22
	13.00	
	Mean	14.67

Folkstone, and Tenterden Church.

Observers.	Five Microscopes.
K.	166 49 58.53
K.	55.58
K.	166 49 60.40
	Mean 58.17

Tolsford (Continued).

Folkstone Pier Flag-staff, and Folkstone Station.				
Observers.	Five Microscopes.	Mean. Five.		
G.	° ′ ″ 13 4 14.75 13.40	″ 14.07		
	Mean	14.07		

Folkstone and Crowborough.				
	Five Microscopes.	Mean. Five.		
	° ′ ″ 170 15 55.25 46.75	″ 51.00		
	Mean	51.00		

Fairlight and Tenterden Church.				
Observers.	Five Microscopes.			
K.	° ′ ″ 29 58 8.75			

Nôtre Dame and Blancnez.				
Observers.	Five Microscopes.			
G.	° ′ ″ 7 32 40.55			

Angles derived at Tolsford.

	°	′	″
Fiennes and Fairlight.....	113	18	17.45
Fiennes and Montlambert	17	30	15.75
Montlambert and Fairlight .	95	48	1.70
Montlambert and Fairlight (observed)	95	48	2.41
Mean...Montlambert and Fairlight	95	48	2.05
Folkstone and Fairlight.....	136	51	46.61
Montlambert and Fairlight	95	48	2.05
Folkstone and Montlambert.	41	3	44.36
Folkstone and Nôtre Dame, Calais	10	44	16.43
Nôtre Dame, Calais, and Fiennes.	12	49	13.97
Fiennes and Montlambert	17	30	15.75
Folkstone and Montlambert.	41	3	46.15
	41	3	44.56
Mean...Folkstone and Montlambert.....	41	3	45.35

	°	′	″
Folkstone and Fairlight	136	51	46.61
Blancnez and Fairlight (observed)	118	34	48.97
Folkstone and Blancnez....	18	16	57.64
Folkstone and Blancnez (observed)	18	16	56.99
Mean...Folkstone and Blancnez	18	16	57.31
Folkstone and Montlambert	41	3	45.35
Folkstone and Blancnez.....	18	16	57.31
Blancnez and Montlambert .	22	46	48.04
Blancnez and Fairlight (observed)	118	34	48.97
Montlambert and Fairlight	95	48	2.05
Blancnez and Montlambert .	22	46	46.92
	22	46	48.04
Mean...Blancnez and Montlambert	22	46	47.48

	°	′	″
Tenterden Church and Folkstone	166	49	58.17
Folkstone and Fairlight	136	51	46.61
Tenterden Church and Fairlight	29	58	11.56
Tenterden Church and Fairlight (observed)	29	58	8.75

	°	′	″
And taking the value of these angles according to the number of the different parts of the circle from which they were obtained, that is as 30 to 10, we have,—			
Mean....Tenterden Church and Fairlight.....	29	58	10.86

Observations for identifying the Station.

	Readings. °	′	″
Beachborough Summer-house ..	55	50	3.00
Stanford Church	28	10	11.62
Ashford Church.....	48	41	6.37
Left-hand Edge of the Summit of Lyme Castle	166	49	5.00
Right-hand Edge of the Summit of Lyme Castle.....	166	56	25.37
Left-hand Edge of the summit of Saltwood Castle	107	14	4.50

At Folkstone Station.

Montlambert, and Dungeness Light-House.

Observers.	Two Microscopes.		Two Microscopes.	
	° ′		″	
A.	75 31		42.75	
K.	75 31		41.00	
C.	75 31		39.75	
G.	75 31		41.13	
A.	75 31		40.01	
K.	75 31		43.50	
A.	75 31		41.75	
A.	75 31		38.87	
	Mean....	....	41.10	

Folkstone Church Vane, and Tolsford.

Observers.	Two Microscopes.		Two Microscopes.	
	° ′		″	
K.	69 13		51.62	
	Mean....	....	51.62	

Dover Flag-staff and Blancnez.

Observers.	Two Microscopes.		Two Microscopes.	
1821.				
	° ′		″	
A.	50 26		43.27	
K.	50 26		47.94	
K.	50 26		46.94	
K.	50 26		47.00	
A.	50 26		47.35	
K.	50 26		51.06	
	Mean....	....	47.28	

Nôtre Dame and Blancnez.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
	° ′ ″	″	″	″
G.	9 21 19.85	18.50	18.75	17.50
	17.15		16.25	
C.	9 21		21.12	
	Mean....	18.50	18.71	

Folkstone Station (Continued).

Fairlight and Tolsford.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
1821.	° ′ ″	″	″	″
C.	36 17		58.13	
1822.				
G.	36 17		59.25	
G.	61.30	58.62	60.87	58.75
	55.95		56.63	
C.	36 17		54.75	
G.	36 17		54.56	
G.	36 17 56.35	55.50	55.13	54.69
	54.65		54.25	
	Mean	57.06	56.70	56.72

Dover Station and Nôtre Dame, Calais.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
	° ′ ″	″	″	″
G.	41 16		25.81	
G.	29.10	30.70	29.88	31.00
	32.30		32.13	
C.	41 16		32.00	
	Mean	30.70	29.95	

Dover Station and Blancnez.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
1821.	° ′ ″	″	″	″
A.	50 37		48.12	
K.	50 37		47.19	
K.	50 37		53.00	
A.	50 37		50.37	
C.	50 37		51.69	
A.	50 37		48.69	
K.	50 37		48.75	
K.	50 37		54.62	
1822.				
G.	50 37 48.95	49.20	48.63	48.50
	49.45		48.38	
C.	50 37		53.12	
	Mean of all..	49.20	50.23	

Blancnez and Montlambert Lamps.

Observers.	Two Microscopes.		Two Microscopes.
	° ′		″
A.	25 1		44.75
K.	25 1		48.31
C.	25 1		47.81
A.	25 1 much	motion	41.88
K.	25 1		48.37
C.	25 1		48.94
G.	25 1		50.00
A.	25 1		46.81
C.	25 1		46.25
K.	25 1		45.94
C.	25 1		45.13
A.	25 1		47.18
K.	25 1		46.31
A.	25 1		47.93
K.	25 1		46.00
A.	25 1		45.41
	Mean	....	46.69

Dover Station and Dover Flag-staff.

Observers.	Two Microscopes.		Two Microscopes.
	° ′		″
A.	0 11		4.75
K.	0 11		0.25
K.	0 11		6.00
A.	0 11		3.12
K.	0 11		3.56
	Mean	....	3.54

Blancnez, and Dungeness Light-House.

Observers.	Two Microscopes.		Two Microscopes.
	° ′		″
A.	100 33		27.50
K.	100 33		29.31
C.	100 33		27.56
A.	100 33		28.56
K.	100 33		23.12
	Mean	....	27.21

Folkstone Station (Continued).

Blancnez and Fairlight.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
1821.	° ′ ″	″	″	″
A.	121 48		17.07	
C.	121 48		08.37	
A.	121 48		15.06	
K.	121 48		11.50	
1822.				
G.	121 48 12.55	14.65	12.50	14.93
	16.75		17.37	
C.	121 48		14.50	
		14.65	13.77	
	Mean used ..	14.13		

Montlambert and Fairlight.

Observers.	Two Microscopes.	Two Microscopes.
	° ′	″
A.	96 46	32.32
C.	96 46	23.24
A.	96 46	27.88
K.	96 46	25.50
C.	96 46	28.82
A.	96 46	25.12
K.	96 46	25.19
C.	96 46	26.63
A.	96 46	25.12
Mean.....		26.65
Rejecting the first and second		26.32

Folkstone Pier Flag-staff and Tolsford.

Observers.	Two Microscopes.		Two Microscopes.	
	° ″		″	
K.	84 37		49.0	
	Mean	....	49.0	

Dungeness Light-House and Fairlight.

Observers.	Two Microscopes.		Two Microscopes.	
	° ′		″	
A.	21 14		49.57	
C.	21 14		52.62	
A.	21 14		46.25	
	Mean	....	49.48	

Nôtre Dame and Fairlight.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
	° ′ ″	″	″	″
G.	131 9		35.76	
G.	32.40	33.15	31.25	32.43
	33.90		33.62	
C.	131 9		35.62	
	Mean	33.15	34.06	

Angles derived at Folkstone.

	°	′	″
Montlambert and Fairlight	96	46	26.32
Montlambert and Blancnez	25	1	46.69
Blancnez and Fairlight	121	48	13.01
Blancnez and Fairlight (observed).....	121	48	14.13
Mean....Blancnez and Fairlight.....	121	48	13.57

Observations for identifying the Station.

	Readings. ° ′ ″		Readings. ° ′ ″
Dover Castle Flag-staff.....	175 51 39.50	Right-hand Summit of nearest Martello Tower.....	99 38 36.25
Summit of the Left Side of Martello Tower nearest the Beach	98 28 28.75	Top of the Flag-staff Folkstone Harbour.....	119 46 45.25
Right-hand Summit of ditto	99 3 38.50	Folkstone Church Vane Spindle	135 10 42.75
Left-hand Summit of nearest Martello Tower	98 47 59.75	Tolsford Station.....	24 24 34.37

At Fairlight.

Stede Hill and Tolsford.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
1821.	° ′ ″	″	″	″
G.	45 27		53.56	
	45 27		55.56	
1822.				
G.	45 27 54.95	55.97		
	57.00			
G.	55.92			
G.	45 27 56.17	54 89		
	53.62			
C.	51.45	51.66		
	51.87			
G.	45 27 54.65	56.07		
	57.50			
G.	45 27 50.20	51.97	51.12	53.46
	53.75		55.81	
	55.85	55.77	57.25	57.06
	55.70		56.87	
	Mean....	54.39	55.03	55.26

Dungeness and Blancnez.

Observers.	Two Microscopes.		Two Microscopes.	
	° ′		″	
K.	4 59		11.00	
G.	4 59		12.12	
A.	4 59		15.13	
G.	4 59		12.68	
C.	4 59		13.41	
	Mean....	....	12.87	

Wrotham and Tolsford Staffs.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
	° ′ ″	″	″	″
G.	77 23 57.62			
G.	56.07	56.98		
	57.90			
G.	77 23 57.55	57.60		
	57.65			
C.	58.40			
G.	77 23 57.75	57.92	53.63	55.87
	58.10		58.12	
	Mean....	57.50		

Wrotham and Tolsford Lamps.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
	° ′ ″	″	″	″
K.	77 23 58.50	57.92		
	57.35			
G.	61.65	60.26		
	58.88			
K.	77 23 60.25	58.21		
	56.18			
G.	77 23 58.35	59.35	59.24	59.74
	60.35		60.25	
K.	58.10	59.55	58.63	55.56
	61.00		62.50	
C.	57.98	59.94	59.81	60.78
	61.90		61.75	
K.	77 23 59.95	61.15	58.75	59.37
	62.35		60.00	
	Mean....	59.48	.....	58.86

Fairlight (Continued).

Crowborough and Stede Hill.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	65° 2′ 35.86″	34.36		
	32.87			
G.	34.65			
G.	65 2 33.43	33.38		
	33.33			
C.	37.98	37.27		
	36.57			
G.	65 2 40.90	38.39	40.25	38.27
	35.88		36.29	
G.	33.50	35.75	34.00	35.81
	38.00		37.63	
	Mean....	35.83	.....	37.04

Folkstone and Dungeness Light-House.

Observers.	Five Microscopes.	Two Microscopes.
G. K.	21° 50′	6.51″
C.	21 50	7.13
G.	21 50	5.25
G.	21 50	12.75
A. C.	21 50	4.50
C.	21 50	2.25
A.	21 50	4.25
K.	21 50	8.06
G.	21 50	4.88
Mean		6.17
Rejecting greatest and least		5.80

Crowborough Staff, and Wrotham Lamp.

Observers.	Five Microscopes.	Mean. Five.
K.	33° 6′ 32.18″	31.91
	31.65	
G.	29.60	
K.	33 6 31.95	29.34
	26.73	
	Mean .. 30.42	30.62

Crowborough and Folkstone.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	117° 20′ 51.25″	49.16		
	47.07			
G.	48.62	48.09		
	47.57			
G.	117 20 46.85	45.55		
	44.25			
C.	45.63	44.58		
	43.54			
G.	117 20		46.37	
	117 20		47.38	
	117 20		47.87	
	117 20		45.37	
	117 20		43.88	
	117 20		47.75	
G.	117 20 45.67	44.62	45.49	44.73
	43.58		43.97	
G.	44.80	45.85	45.37	46.06
	46.90		46.75	
	Mean	46.31	46.02	

Blancnez, and Fairlight Church.

Observers.	Two Microscopes.	Two Microscopes.
G.	6° 16′	28.00″
A.	6 16	27.81
K.	6 16	29.63
C.	6 16	26.63
	Mean	28.01

Dungeness Light-House and Montlambert.

Observers.	Two Microscopes.	Two Microscopes.
K.	22° 38′	42.13″
G.	22 38	35.25
A.	22 38	40.50
G.	22 38	38.87
K.	22 38	36.50
	Mean	38.65

Fairlight (Continued).

Tolsford and Folkstone.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
1821.				
G.	6° 50′ ″	″	″ 14.69	
G. & C.	6 50		11.38	
K. & G.	6 50		14.94	
G.	6 50		16.75	
1822.				
G.	6 50 20.44	18.82		
	17.20			
K.	18.58	17.97		
	17.37			
G.	18.05	18.48		
	18.92			
G.	6 50 17.25	17.27		
	17.30			
C.	16.20	15.65		
	15.10			
G.	6 50 17.65	18.72		
	19.80			
G.	6 50 14.57	14.26	14.12	12.99
	13.95		11.87	
G.	15.45	14.32	14.12	13.18
	13.20		12.25	
	Mean	16.94	13.77	13.08

Spire for the Pole Star and Folkstone.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	62° 50′ ″ 55.15	″	″	″
G.	62 50 54.10	53.92	54.74	54.18
	53.75		53.62	
	Mean.. 54.33			

Fairlight Church and Montlambert.

Observers.	Two Microscopes.		Two Microscopes.	
A.	11° 22′		″ 58.19	
K.	11 22		61.50	
	Mean	....	59.84	

Crowborough and Wrotham Staffs.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	33° 6′ ″ 32.25	″	″	″
G.	34.50	32.62		
	30.75			
G.	33 6 32.05	30.67		
	29.30			
C.	31.03			
G.	33 6 31.60	33.60	37.62	37.00
	35.60		36.38	
	Mean .. 32.14	32.29		

Crowborough and Tolsford.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	110° 30′ ″ 30.81	″	″	″
	29.87	30.34		
G.	30.57	29.61		
	28.65			
G.	110 30 29.60	28.27		
	26.95			
C.	29.43	28.93		
	28.44			
G.	110 30 31.10	30.61	31.37	29.63
	30.13		27.90	
G.	29.35	31.52	31.25	32.87
	33.70		34.50	
	Mean	29.88	.....	31.25

Wrotham and Stede Hill.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	31° 56′ ″ 0.62	″	″	″
G.	0.15			
G.	31 56 1.38	2.71		
	4.03			
C.	6.95			
G.	31 56 1.90	2.15	6.38	3.81
	2.40		1.25	
	Mean .. 2.49	2.43		

Fairlight (Continued).

Wrotham and Tolsford.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
	° ′ ″	″	″	″
K.	77 23 58.50	57.92		
	57.35			
G.	61.65	60.26		
	58.88			
G.	77 23 57.62			
K.	60.25	58.21		
	56.18			
G.	56.07	56.98		
	57.90			
G.	77 23 57.55	57.60		
	57.65			
C.	58.40			
G.	77 23 58.35	59.35	59.24	59.74
	60.35		60.25	
K.	58.10	59.55	58.63	60.56
	61.00		62.50	
C.	57.98	59.94	59.81	60.78
	61.90		61.75	
K.	77 23 59.95	61.45	58.75	59.38
	62.95		60.00	
G.	57.75	57.92	53.63	55.88
	58.10		58.12	
	Mean	58.92		59.27

Blancnez and Montlambert.

Observers.	Two Microscopes.		Two Microscopes.	
	° ′		″	
A.	17 39		26.00	
K.	17 39		31.13	
G.	17 39		23.13	
A.	17 39		25.37	
G.	17 39		26.19	
	Mean	....	26.36	

Tenterden Church and Tolsford.

Observer.	Two Microscopes.		Two Microscopes.	
	° ′		″	
G.	39 19		36.44	

Tenterden Church and Folkstone.

Observers.	Two Microscopes.		Two Microscopes.	
	° ′		″	
G.	46 9		50.87	
C. & A.	46 9		46.50	
K. & G.	46 9		51.38	
	Mean		49.58	

Spire for the Pole Star and Tolsford.

Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
	° ′ ″	″	″	″
G.	56 0 37.90			
G.	56 0 39.53	39.66	40.62	41.18
	39.80		41.75	
	Mean.. 39.08			

Frant and Stede Hill.

Observer.	Five Microscopes.		Two Microscopes.	
	° ′ ″		″	
	51 18		19.18	
	51 18		16.13	
G.	51 18 13.53			
	Mean 13.53	....	17.65	

Folkstone, and Fairlight Church.

Observers.	Two Microscopes.		Two Microscopes.	
	° ′		″	
C. & A.	33 5		45.56	
C.	33 5		41.63	
A.	33 5		46.12	
K.	33 5		47.81	
	Mean	....	45.28	

Fairlight (Continued).

Frant Church and Tenterden Church.				
Observers.	Two Microscopes.		Two Microscopes.	
K. & G.	° ′ 57 26		″ 31.87	
C.	57 26		41.12	
A.	57 26		38.13	
	Mean	....	37.04	

Frant and Crowborough.				
Observer.	Five Microscopes.			
G.	° ′ ″ 13 44 19.90			

Wrotham and Folkstone.				
Observers.	Five Microscopes.	Mean. Five.	Two Microscopes.	Mean. Two.
G.	° ′ ″ 84 14 14.82	″	″	″
G.	14.12	15.47		
	16.82			
G.	84 14 14.80	14.87		
	14.95			
C.	14.60			
G.	84 14 13.20	12.25	7.75	9.06
	11.30		10.37	
	Mean.. 14.33	14.19		

Angles derived at Fairlight.

	°	′	″
Folkstone and Montlambert	44	28	44.74
Folkstone and Tolsford	6	50	16.94
Tolsford and Montlambert ..	51	19	1.68
Folkstone and Dungeness	21	50	5.80
Dungeness and Blancnez	4	59	12.87
Folkstone and Blancnez.....	26	49	18.67
Folkstone and Blancnez, using the mean of all the angles between Folkstone and Dungeness	26	49	19.04
Tolsford and Folkstone	6	50	16.94
Tolsford and Blancnez.....	33	39	35.99

	°	′	″
Folkstone and Blancnez	26	49	18.67
Blancnez and Montlambert	17	39	26.36
Folkstone and Montlambert .	44	28	45.03
Folkstone and Dungeness	21	50	5.80
Dungeness and Montlambert.....	22	38	38.65
	44	28	44.45
	44	28	45.03
Mean...Folkstone and Montlambert.....	44	28	44.74
Tenterden Church and Folkstone .	46	9	49.58
Tolsford and Folkstone	6	50	16.94
Tenterden Church and Tolsford	39	19	32.64
Stede Hill and Frant Church	51	18	15.59
Crowborough and Stede Hill	65	2	35.83
Frant Church and Crowborough	13	44	20.24

Observations for identifying the Station.

	Readings.		
	°	′	″
Ashford Tower	176	0	7.62
Mr. Fuller's Observatory Dome	84	37	51.12
Roy's Station	113	33	57
Church about three miles	131	32	13.25
West Edge of Fairlight Mill	149	55	59.25
East Edge of Fairlight Mill	130	54	24.62
Hastings Church	4	9	9.12
Dungeness Light-House	46	9	36.50
Fairlight Church	57	25	13.49

From the Station to the nearest angle of the Windmill, 69 feet 2 inches.
Roy's Station from the nearest angle of the Windmill, 26 feet 4 inches.
Roy's Station from the new Station, 87 feet 8¼ inches.

At Blancnez.

Montlambert Lamp and Fairlight Lamp.	Montlambert Lamp and Folkstone Lamp.	Montlambert Staff and Fiennes.	Folkstone Lamp and Tolsford.
Two Microscopes.	Two Microscopes.	Two Microscopes.	Two Microscopes.
° ′ ″	° ′ ″	° ′ ″	° ′ ″
75 56 24.64	107 18 56.17	51 21 34.19	3 36 52.37
75 56 23.98	107 18 55.71	51 21 35.18	3 36 50.05
75 56 23.03	107 18 53.64	51 21 33.88	3 36 52.78
75 56 25.25	107 18 57.18	51 21 33.12	
75 56 25.53	107 18 56.78	51 21 29.97	Mean 3 36 51.73
		51 21 37.53	
Mean 75 56 24.49	Mean 107 18 55.90	Mean 51 21 33.98	
Fairlight Lamp and Folkstone Lamp.	Dungeness, and Folkstone Lamp.	Dungeness, and Montlambert Lamp.	Folkstone Staff and Dover Station.
° ′ ″	° ′ ″	° ′ ″	° ′ ″
31 22 30.72	28 58 55.91	78 20 0.33	12 3 50.81
31 22 33.99	28 59 2.06		12 3 53.44
31 22 27.82	28 58 55.84	78 20 0.33	12 3 51.41
31 22 30.56			Mean 12 3 51.88
31 22 33.30	Mean 28 58 57.94		Add 2.00
31 22 28.03		Nôtre Dame Calais, and Folkstone Lamp.	12 3 53.88
31 22 30.60	Dungeness, and Fairlight Lamp.		
31 22 29.91		° ′ ″	Dover Station and Nôtre Dame Calais.
31 22 31.27	° ′ ″	131 56 37.34	
31 22 32.61	2 23 35.36	131 56 39.23	° ′ ″
31 22 31.53	2 23 29.47	131 56 40.39	119 52 47.12
31 22 31.53	2 23 35.69	131 56 39.53	119 52 53.53
31 22 32.68			
31 22 31.25	Mean 2 23 33.51	Mean 131 56 39.12	Mean 119 52 50.32
Mean 31 22 31.13			

Blancnez (Continued).

Folkstone Staff and Tolsford.	Dover Castle Flag-staff and Folkstone Staff.	Nôtre Dame Calais, and Fiennes.	North Foreland Light-House, and Folkstone Staff.
Two Microscopes.	Two Microscopes.	Two Microscopes.	Two Microscopes.
3° 36′ 50.00	12° 1′ 15.43	69° 22′ 50.78	41° 51′ 11.50
3 36 51.63	12 1 15.75	69 22 53.50	Add.... 2.00
3 36 48.88	12 1 17.75	69 22 54.23	41 51 13.50
3 36 53.37	Mean 12 1 16.31	69 22 56.31	
3 36 49.63	Add..... 2.00	69 22 52.92	Montlambert Lamp and Fiennes.
3 36 51.25	12 1 18.31	69 22 52.79	51° 21′ 30.67
3 36 54.88		69 22 53.63	51 21 27.04
Mean 3 36 51.38	Dover Station, and Dover Castle Flag-staff.	Mean 69 22 53.45	51 21 29.85
Subtract.... 2.00	0° 2′ 33.66	Folkstone Staff, and South Foreland High Light.	51 21 32.16
3 36 49.38	0 2 35.38	17° 54′ 17.50	51 21 30.29
	0 2 37.69	Add.... 2.00	Mean 51 21 30.00
Nôtre Dame Calais, and Folkstone Staff.	Mean 0 2 35.58	17 54 19.50	Centre of Dunkirk Tower, and Nôtre Dame Calais.
131° 56′ 44.94	Tolsford, and Fairlight Staff.	Folkstone Lamp, and South Foreland High Light.	5° 13′ 50.87
131 56 39.22	27° 45′ 41.86	17° 54′ 11.27	5 13 49.98
131 56 37.93	27 45 42.62	17 54 11.27	5 13 50.91
131 56 37.43	27 45 37.13	Folkstone Lamp, and South Foreland Low Light.	5 13 50.28
Mean 131 56 39.88	27 45 36.25	17° 24′ 16.55	Mean 5 13 50.51
Add.... 2.00	Mean 27 45 39.46	17 24 16.55	Dover Castle Flag-staff and Nôtre Dame Calais.
131 56 41.88	Subtract.. 0.49	Fairlight, and South Foreland Low Light.	119° 55′ 22.50
Fairlight, and South Foreland High Light.	27 45 38.97	48° 46′ 47.82	119 55 27.19
49° 16′ 42.54	Tolsford, and Fairlight Lamp.	48 46 47.82	Mean 119 55 24.84
49 16 42.54	27° 45′ 38.23		
Folkstone Staff, and South Foreland Low Light.	27 45 39.86		
17° 24′ 16.37	27 45 38.75		
Add.... 2.00	Mean 27 45 38.95		
17 24 18.37			

Angles derived at Blancnez.

	°	′	″
Montlambert and Folkstone	107	18	55.90
Folkstone and Tolsford $\frac{(3° 36' 49''.38 \times 7) + (3° 36' 51''.73 \times 3)}{10}$ =	3	36	50.09
Montlambert and Tolsford	103	42	5.81
Fairlight and Folkstone	31	22	31.13
Tolsford and Folkstone	3	36	50.09
Fairlight and Tolsford	27	45	41.04
Fairlight and Tolsford (observed)	27	45	38.95
Mean....Fairlight and Tolsford	27	45	39.99

The Station at Blancnez is in a right line drawn from the Ball of Nôtre Dame, Calais, to a point upon the wall of the Guard-house, distant from the north edge of the house 4 feet 3.25 inches, and from the north-east edge 14 feet 10.3 inches. Mr. GARDNER cut a cross upon the wall, marking this point. The distance on the ground from a vertical line passing through the cross to the Station is 107 feet 5 inches.

At Montlambert.

	Folkstone Lamp and Blancnez.
Observers.	Two Microscopes.
K.	47° 39′ 18″.25
A.	47 39 19.44
G.	47 39 21.00
M.	47 39 19.75
C.	47 39 20.75
A.	47 39 18.87
K.	47 39 16.93
A.	47 39 17.19
A.	47 39 17.25
A. & C.	47 39 15.50
Mean..	....47 39 18.49

	Dungeness, and Folkstone Lamp.
Observers.	Two Microscopes.
A.	27° 56′ 55″.62
	27 56 55.62

	Dungeness and Blancnez.
Observers.	Two Microscopes.
C.	75° 51′ 13″.63
A. C.	75 51 14.87
Mean..	....75 51 14.25

	Dungeness, and Fairlight Lamp.
A.	10° 47′ 54″.25
	10 47 54.25

	S. Foreland Light and Folkstone.
C.	14° 35′ 16″.12
	14 35 16.12

	Fairlight Lamp and Tolsford.
A.	32° 53′ 1″.62
	32 53 1.62

	Fairlight Mill and Folkstone.
A.C.&K.	38° 46′ 0″.48
	38 46 0.48

	S. Foreland Light* and Folkstone.
A. & C.	14° 58′ 42″.5
	14 58 42.5

* There are two Lights at the South Foreland, the High and the Low Light.

Montlambert (Continued).

	Fairlight Lamp and Folkstone Lamp.
Observers.	Two Microscopes.
A.	38 44 55.94
K.	38 44 57.44
C.	38 44 50.38
A.	38 44 52.44
K.	38 44 54.50
C.	38 44 52.82
A. & C.	38 44 56.75
..	.....
C.	38 44 52.63
A.	38 44 52.57
K.	38 44 55.75
C.	38 44 49.92
A.	38 44 49.87
Mean..	....38 44 53.42

	Tolsford and Folkstone Staff.
	° ′ ″
C.	5 51 52.32
A. & C.	5 51 49.56
Mean..	.... 5 51 50.94

	Tolsford and Blancnez.
Observers.	Two Microscopes.
C.	53 31 8.79
C.	53 31 12.00
A. & C.	53 31 6.44
Mean.....	53 31 9.08

	Fiennes and Tolsford.
	° ′ ″
C.	87 58 48.58
C.	87 58 50.50
A. & C.	87 58 47.36
Mean..	....87 58 48.81

	Fiennes and Blancnez.
Observers.	Two Microscopes.
K.	34 27 39.68
G.	34 27 40.06
M.	34 27 37.62
C.	34 27 39.79
K.	34 27 41.37
K.	34 27 39.75
A.	34 27 41.07
C.	34 27 39.18
K.	34 27 40.31
C.	34 27 38.68
C.	34 27 38.50
A.	34 27 40.88
A. & C.	34 27 40.92
Mean..	.... 34 27 39.83

Angles derived at Montlambert.

	°	′	″
Fairlight and Folkstone	38	44	53.43
Tolsford and Folkstone	5	51	50.94
Fairlight and Tolsford	32	53	2.49
Fairlight and Tolsford (observed)	32	53	1.62
Mean....Fairlight and Tolsford	32	53	2.05
Fairlight and Folkstone	38	44	53.43
Folkstone and Blancnez	47	39	18.49
Fairlight and Blancnez	86	24	11.91

	°	′	″
Folkstone and Blancnez	47	39	18.49
Tolsford and Folkstone	5	51	50.94
Tolsford and Blancnez	53	31	9.43
Tolsford and Blancnez (observed)	53	31	9.08
Mean....Tolsford and Blancnez	53	31	9.25

The Station at Montlambert is on the North Bastion, about $7\frac{1}{2}$ feet from the angle, measuring from the foot of the parapet, and equally distant from the faces.

Observations *of the Pole Star.*

1821, October 3rd, at Blancnez. In the evening. Chronometer slow $1^m\ 46^s.4$ on Mean Time.

	Readings.
Nôtre Dame, Calais	51° 49′ 43″.06
South Foreland High Light	117 47 13 .55
South Foreland Low Light	117 17 18 .63

Chronometer.	Mean Horary Angle.	Reading at the Star.	Mean Reading at the Star.	Azimuth.	Reading at the Meridian.
h m s	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″
5 59 23.5	91 8 4	164 38 46.50	164 38 54.81	2 35 59	162 2 55.81
6 6 53.0		164 39 3.12			
6 13 10.0	88 10 34	164 39 10.25	164 39 11.12	2 36 14	162 2 57.12
6 16 43.0		164 39 12.00			
6 18 35.0	87 3 46	164 39 11.37	164 39 11.49	2 36 13	162 2 58.49
6 20 5.0		164 39 11.62			
6 21 21.0	86 19 46	164 39 9.87	164 39 9.31	2 36 10	162 2 59.31
6 23 16.0		164 39 8.75			
Telescope inverted.					
6 43 49.0	80 37 20	164 38 12.25	164 38 5.81	2 34 56	162 3 9.81
6 46 19.0		164 37 59.37			

	Readings.
South Foreland High Light	117° 47′ 16″.21
South Foreland Low Light	117 17 22 .53

1822, August 25th, at Fairlight. In the morning. Chronometer slow $3^m\ 7^s.64$ on Mean Time.

	Reading.
Summit of the Spire of a Church	134° 18′ 59″.30

Chronometer.	Mean Horary Angle.	Reading at the Star.	Mean Reading at the Star.	Azimuth.	Reading at the Meridian.
h m s	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″
8 58 43.50	94 19 42	135 47 31.0	135 47 37.5	2 34 54	138 22 31.50
9 1 11.50		135 47 44.0			
Telescope inverted.					
9 11 28.00	97 27 58	135 48 33.75	135 48 40.2	2 33 45	138 22 25.20
9 13 28.30		135 48 46.65			

	Reading.
Summit of the Spire	134° 19′ 0″.27

Much motion in the Spire.

1822, August 25th, at Fairlight. In the evening. Chronometer slow $3^m\ 7^s.64$ on Mean Time.

Reading.

Wrotham Lamp ..... 112° 55′ 34″.4

Chronometer.	Mean Horary Angle.	Reading at the Star.	Mean Reading at the Star.	Azimuth.	Reading at the Meridian.
h m s	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″
8 39 9	89 59 43.6	140 58 6.25	140 58 8.62	2 35 46	138 22 22.62
8 42 59		140 58 11.00			
8 45 59	88 22 14	140 58 14.65	140 58 14.72	2 35 52	138 22 22.72
8 48 27		140 58 14.80			
Telescope inverted.					
8 52 20	86 49 28.4	140 58 18.60	140 58 17.62	2 35 49	138 22 28.62
8 54 25.7		140 58 16.65			
8 58 15	85 36 16	140 58 8.55	140 58 8.55	2 35 44	138 22 24.55

Reading.

Wrotham Lamp ..... 112° 55′ 33″.00

August 26th, at Fairlight. In the evening. Chronometer slow $3^m\ 9^s.9$ on Mean Time.

Reading.

Wrotham Lamp ..... 99° 36′ 33″.97

Chronometer.	Mean Horary Angle.	Reading at the Star.	Mean Reading at the Star.	Azimuth.	Reading at the Meridian.
h m s	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″
8 39 42	89 2 12.50	127 39 18.20	127 39 19.80	2 35 50	125 3 29.8
8 41 51		127 39 21.35			
8 44 4	87 55 24	127 39 24.05	127 39 23.22	2 35 51	125 3 32.22
8 46 22		127 39 22.40			
Telescope inverted.					
8 49 50	86 30 25.50	127 39 18.05	127 39 16.25	2 35 49	125 3 27.25
8 51 54		127 39 14.45			
8 53 55	85 33 38.50	127 39 11.65	127 39 10.22	2 35 44	125 3 26.22
8 55 22		127 39 8.80			

Reading.

Wrotham Lamp ..... 99° 36′ 35″.58

Much motion in the Lamp.

August 27th, at Fairlight. In the evening. Chronometer slow $3^m\ 12^s.1$ on Mean Time.

Reading.

Tolsford Lamp ..... 4° 48′ 41″.50

Chronometer.	Mean Horary Angle.	Reading at the Star.	Mean Reading at the Star.	Azimuth.	Reading at the Meridian.
h m s	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″
8 36 59	88 39 23.50	135 27 38.00	135 27 33.40	2 35 51	132 51 42.40
8 39 20		135 27 28.80			
8 40 49	87 51 1.00	135 27 36.95	135 27 36.77	2 35 52	132 51 44.77
8 41 56		135 27 36.60			
8 43 3	87 25 49.00	135 27 35.85	135 27 35.85	2 35 51	132 51 44.85
Telescope inverted.					
8 45 19	86 21 09.00	135 27 14.80	135 27 21.62	2 35 48	132 51 33.62
8 49 23		135 27 28.45			
8 50 44	85 30 15.00	135 27 22.55	135 27 22.55	2 35 42	132 51 40.55

Reading.

Tolsford Lamp..... 4° 48′ 35″.08

September 7th, at Tolsford. In the morning. Chronometer slow $5^m\ 40^s$ on Mean Time.

Reading.

Folkstone Staff ..... 34° 32′ 27″.43

Chronometer.	Mean Horary Angle.	Reading at the Star.	Mean Reading at the Star.	Azimuth.	Reading at the Meridian.
h m s	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″
7 25 27	84 26 42.50	116 29 33.45	116 29 30.42	2 36 14	119 5 44.42
7 28 32		116 29 27.40			
7 30 42	85 53 4.50	116 29 22.10	116 29 18.77	2 36 25	119 5 43.77
7 36 46		116 29 15.45			
7 41 14	88 20 13.00	116 29 12.45	116 29 12.95	2 36 32	119 5 44.95
7 43 48		116 29 13.45			
Telescope inverted.					
7 48 7	89 55 6	116 29 1.60	116 29 2.72	2 36 26	119 5 28.72
7 49 32		116 29 3.85			
7 51 24	90 49 0	116 29 7.55	116 29 59.7	2 36 20	119 5 29.75
7 53 25		116 29 11.95			
8 2 32	93 37 5	116 29 40.95	116 29 43.72	2 35 46	119 5 29.72
8 4 38.5		116 29 46.50			

Reading.

Folkstone Staff ..... 34° 32′ 16″.25

September 19th, at Crowborough. In the morning. Chronometer slow $2^m\ 15^s$ on Mean Time.

Reading.

Frant Church Staff ..... 12° 4′ 8″.55

Chronometer.	Mean Horary Angle.	Reading at the Star.	Mean Reading at the Star.	Azimuth.	Reading at the Meridian.
h m s	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″
6 59 30	88 44 47.00	129 54 14.55	129 54 16.07	2 36 14	132 30 30.07
7 1 24		129 54 17.60			
7 2 37	89 17 23.00	129 54 19.05	129 54 19.05	2 36 12	132 30 31.05
Telescope inverted.					
7 4 22	89 59 59.60	129 54 17.35	129 54 18.27	2 36 9	132 30 27.27
7 6 32		129 54 19.20			
7 7 37	90 38 43.00	129 54 19.95	129 54 21.25	2 36 5	132 30 26.25
7 8 48		129 54 22.55			

Reading.

Frant Church Staff..... 12° 4′ 6″.17

September 20th, at Crowborough. In the morning. Chronometer slow $2^m\ 17^s.6$ on Mean Time.

Reading.

Frant Church Staff (motion) ..... 12° 4′ 22″.7

Chronometer.	Mean Horary Angle.	Reading at the Star.	Mean Reading at the Star.	Azimuth.	Reading at the Meridian.
h m s	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″
6 39 54	84 45 38	129 54 46.40	129 54 45.47	2 36 0	132 30 45.47
6 41 20		129 54 44.55			
6 42 29	85 23 14	129 54 41.60	129 54 40.00	2 36 5	132 30 45.00
6 43 45		129 54 38.40			
6 45 37	86 8 43.50	129 54 35.50	129 54 34.82	2 36 10	132 30 44.82
6 46 40		129 54 34.15			
6 47 55	86 44 42.40	129 54 32.60	129 54 31.75	2 36 13	132 30 44.75
6 49 9		129 54 30.90			
Telescope inverted.					
6 53 13	88 2 55.50	129 54 46.45	129 54 46.50	2 36 15	132 31 1.50
6 54 15		129 54 46.55			
6 55 15	88 40 16.00	129 54 47.05	129 54 47.40	2 36 14	132 31 1.40
6 57 11		129 54 47.75			
6 58 51	88 56 16.00	129 54 49.10	129 54 49.77	2 36 13	132 31 2.77
6 59 42		129 54 50.45			
7 1 46	90 3 45.00	129 54 54.55	129 54 54.55	2 36 9	132 31 3.55

Reading.

Frant Church Staff (steady) ..... 12° 4′ 34″.01

September 21st, at Crowborough. In the morning. Chronometer slow $2^m\ 19^s.6$ on Mean Time.

Reading.

Frant Church Staff ..... 160° 14′ 11″.73

Chronometer.	Mean Horary Angle.	Reading at the Star.	Mean Reading at the Star.	Azimuth.	Reading at the Meridian.
h m s	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″
6 41 32	86 36 33.60	98 4 25.55	98 4 23.92	2 36 12	100 40 35.92
6 44 11		98 4 22.30			
6 47 11	87 41 37.00	98 4 20.90	98 4 20.90	2 36 15	100 40 35.90
Telescope inverted.					
6 50 8	88 40 16.40	98 4 31.45	98 4 31.82	2 36 14	100 40 45.82
6 52 2		98 4 32.20			
6 53 42	89 27 46.40	98 4 33.80	98 4 33.97	2 36 11	100 40 44.97
6 54 47		98 4 34.15			

Reading.

Frant Church Staff ..... 160° 14′ 18″.66

Deductions from the preceding Tables.

Blancnez.

1821, October 3rd: Mean Reading at the Meridian	162°	2′	57″.68
At Nôtre Dame, Calais	51	49	43.06
Between Nôtre Dame Calais, and the Meridian	69	46	45.38
Between Nôtre Dame Calais, and Fairlight	163	19	11.63
Between Fairlight and the Meridian	93	32	26.25
Between Fairlight and the Meridian, using the South Foreland High Light	93	32	26.67
Between Fairlight and the Meridian, using the South Foreland Low Light	93	32	26.87
Mean . .	93	32	26.60

	°	′	″
Reading at the Meridian (the Telescope inverted)	162	3	9.81
At the South Foreland High Light	117	47	16.21
Between the South Foreland High Light and the Meridian	44	15	53.60
Between the South Foreland High Light and Fairlight	49	16	42.54
Between Fairlight and the Meridian (Telescope inverted)	93	32	36.14
Between Fairlight and the Meridian, using South Foreland Low Light (Telescope inverted)	93	32	35.10
Mean	93	32	35.62
Mean (above)	93	32	26.60
Between Fairlight and the Meridian	93	32	31.11

Fairlight.

	°	′	″
1822, 25th August A.M. Reading at the Meridian	138	22	31.50
Spire of a Church	134	18	59.30
Between the Spire and the Meridian	4	3	32.20
Between Folkstone and the Spire	62	50	54.33
Between Folkstone and the Meridian	58	47	22.13
Between Folkstone and Blancnez	26	49	18.67
Between Blancnez and the Meridian	85	36	40.80
Reading at the Meridian (Telescope inverted)	138	22	25.20
Spire of a Church	134	19	0.27
Between the Spire and the Meridian	4	3	24.93
Between Folkstone and the Spire	62	50	54.33
Between Folkstone and the Meridian (Telescope inverted)	58	47	29.40
Between Folkstone and Blancnez	26	49	18.67
Between Blancnez and the Meridian (Telescope inverted)	85	36	48.07
Between Blancnez and the Meridian (above)	85	36	40.80
Between Blancnez and the Meridian (Mean)	85	36	44.43

	°	′	″
25th August P.M. Mean Reading at the Meridian	138	22	22.62
Wrotham Lamp	112	55	34.40
Between Wrotham and the Meridian	25	26	48.22
Between Wrotham and Blancnez	111	3	32.87
Between Blancnez and the Meridian	85	36	44.65
Mean Reading at the Meridian (Telescope inverted)	138	22	26.58
Wrotham Lamp	112	55	33.00
Between Wrotham and the Meridian	25	26	53.58
Between Wrotham and Blancnez	111	3	32.87
Between Blancnez and the Meridian (Telescope inverted)	85	36	39.29
Between Blancnez and the Meridian (above)	85	36	44.65
Between Blancnez and the Meridian . . . Mean . .	85	36	41.97
26th August P.M. Mean reading at the Meridian	125	3	31.01
Wrotham Lamp	99	36	33.97
Between Wrotham and the Meridian	25	26	57.04
Between Wrotham and Blancnez	111	3	32.87
Between Blancnez and the Meridian	85	36	35.83
Mean Reading at the Meridian (Telescope inverted)	125	3	26.73
Wrotham Lamp	99	36	35.58
Between Wrotham and the Meridian	25	26	51.15
Between Wrotham and Blancnez	111	3	32.87
Between Blancnez and the Meridian (Telescope inverted)	85	36	41.72
Between Blancnez and the Meridian (above)	85	36	35.83
Between Blancnez and the Meridian . . . Mean . .	85	36	38.77

	°	′	″
27th August P.M. Mean Reading at the Meridian	132	51	44.00
Tolsford Lamp	4	48	41.50
Between Tolsford and the Meridian	51	56	57.50
Between Tolsford and Blancnez	33	39	35.99
Between Blancnez and the Meridian	85	36	33.49

	°	′	″
Mean Reading at the Meridian (Telescope inverted)	132	51	37.08
Tolsford Lamp	4	48	35.08
Between Tolsford and the Meridian	51	56	58.00
Between Tolsford and Blancnez	33	39	35.99
Between Blancnez and the Meridian (Telescope inverted)	85	36	33.99
Between Blancnez and the Meridian (above)	85	36	33.49

Between Blancnez and the Meridian . . Mean . .	85	36	33	74

Summary.

At Fairlight, the Angle between the Meridian and Blancnez:

	°	′	″
August 25, A.M. . .	85	36	44.43
P.M. . .	85	36	41.97
August 26, P.M. . .	85	36	38.77
August 27, P.M. . .	85	36	33.74
Between the Meridian and Blancnez	85	36	39.73
Between Tolsford and Blancnez	33	39	35.99
Between the Meridian and Tolsford	51	57	3.74
Between Crowborough and Tolsford	110	30	29.88
Between the Meridian and Crowborough	58	33	26.14

Tolsford.

1822. September 7th, A.M. Reading at the Meridian . . .	119°	5′	44.38″
Folkstone	34	32	27.40
Between Folkstone and the Meridian	95	26	43.02
Between Folkstone and Crowborough	189	44	6.50
Between Crowborough and the Meridian	94	17	23.48
Mean reading at the Meridian (Telescope inverted)	119°	5′	29.39″
Folkstone	34	32	16.25
Between Folkstone and the Meridian	95	26	46.86
Between Folkstone and Crowborough	189	44	6.50
Between Crowborough and the Meridian (Telescope inverted)	94	17	19.64
Between Crowborough and the Meridian (above) . . .	94	17	23.48
Between Crowborough and the Meridian. . . Mean .	94	17	21.56

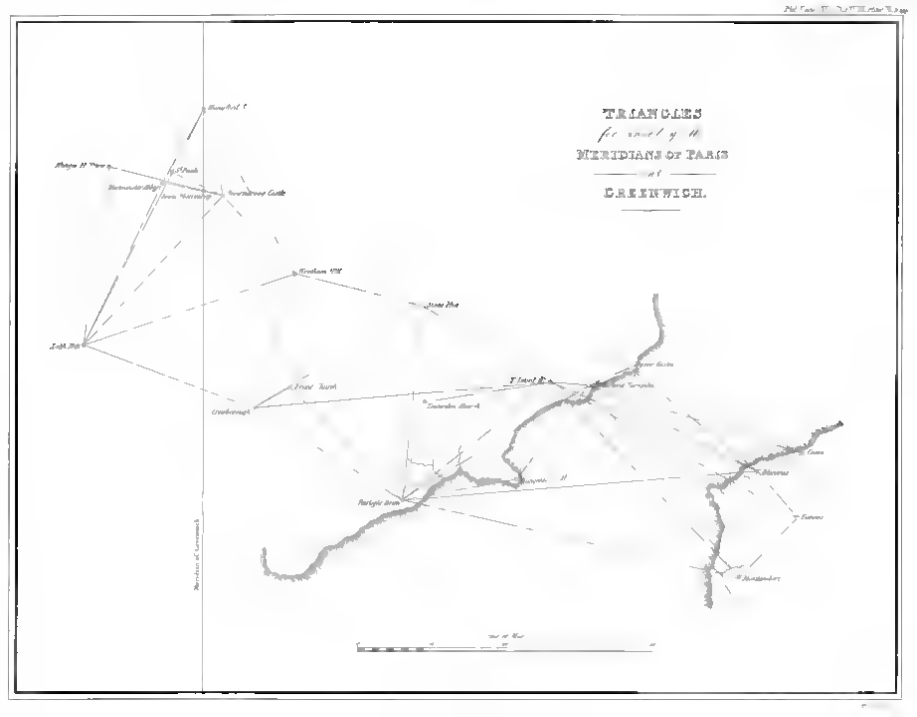
Crowborough.

September 19th, A.M. Mean reading at the Meridian . . .	132°	30′	30.56″
Frant Church . . .	12	4	8.55
Between Frant and the Meridian	59	33	37.99
Between Tolsford and Frant	25	25	58.37
Between Tolsford and the Meridian	84	59	36.36
Mean reading at the Meridian (Telescope inverted)	132°	30′	26.76″
Frant Church	12	4	6.17
Between Frant and the Meridian	59	33	39.41
Between Tolsford and Frant	25	25	58.37
Between Tolsford and the Meridian (Telescope inverted) .	84	59	37.78
Between Tolsford and the Meridian (above)	84	59	36.36
Between Tolsford and the Meridian. . . Mean . . .	84	59	37.07

September 20th, A.M. Mean reading at the Meridian . . .	132°	20′	45.01″
Frant Church . . .	12	4	22.70
Between Frant and the Meridian	59	33	37.69
Between Tolsford and Frant	25	25	58.37
Between Tolsford and the Meridian	84	59	36.06
Mean reading at the Meridian (Telescope inverted)	132°	31′	2.30″
Frant Church	12	4	34.01
Between Frant and the Meridian	59	33	31.71
Between Tolsford and Frant	25	25	58.37
Between Tolsford and the Meridian (Telescope inverted) .	84	59	30.08
Between Tolsford and the Meridian (above)	84	59	36.06
Between Tolsford and the Meridian. . . Mean . . .	84	59	33.07
September 21st., A.M. Mean reading at the Meridian . . .	100°	40′	35.91″
Frant Church . . .	160	14	11.73
Between Frant and the Meridian	59	33	35.82
Between Tolsford and Frant.	25	25	58.37
Between Tolsford and the Meridian	84	59	34.19
Mean reading at the Meridian (Telescope inverted)	100°	40′	45.39″
Frant Church	160	14	18.66
Between Frant and the Meridian	59	33	33.27
Between Tolsford and Frant	25	25	58.37
Between Tolsford and the Meridian (Telescope inverted) .	84	59	31.64
Between Tolsford and the Meridian (above)	84	59	34.19
Between Tolsford and the Meridian. . . Mean . . .	84	59	32.91

Summary.

	°	′	″
At Crowborough the Angle between the Meridian and Tolsford—19th September, A.M.	84	59	37.07
20th September, A.M.	84	59	33.07
21st September, A.M.	84	59	32.91
Between the Meridian and Tolsford	84	59	34.35
Between Crowborough and Fairlight	36	5	24.01
Between the Meridian and Fairlight	121	4	58.36


TRIANGLES
for connecting the
MERIDIANS OF PARIS
and
GREENWICH.
Meridian of Greenwich